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An Unrealistic Image of Science

I. Z. Abrahams

The image of science as an exciting practical activity, that many science teachers try to generate on Open Days, creates an unrealistic and ultimately unsustainable image of 'real' science.

Abstract

Many UK secondary schools (ages 11-18) host Open Days for pupils in their final year of primary school education (age 10). At these events science teachers try, through the judicious use of a select number of practical tasks, to portray science as being a fun, exciting and essentially a 'hands on' activity. Whilst this approach generates short-term situational interest amongst pupils it is ultimately an unrealistic, and arguably unsustainable, image of science.

Key words: Image, Practical Work, Unsustainable

Background

The results presented here are drawn from a larger PhD study by the author that critically explored the use and effectiveness of practical work using the two-level model of effectiveness proposed by Millar et al. (1999) linked to Tiberghien's (2000) two-domains model of knowledge as an analytical framework. The study was based on twenty-five multi-site case studies in which data was collected using tape-recorded interviews and observational field notes from a sample of practical lessons undertaken by pupils in English comprehensive schools during Key Stages 3 and 4. All names of schools and teachers are pseudonyms.

[TABLE 1 GOES HERE]

Whilst the selection of schools was opportunistic the sample was broadly representative of comprehensive schools across three educational authorities in terms

of size, status and environmental setting. Such a selection process was principally concerned with ensuring what Bell et al. (1984) refer to as "naturalistic coverage" (p. 75) rather than with meeting the statistical sampling requirements associated with traditional quantitative research.

The unrealistic image of science presented through Open Days

Science teachers, I have often thought, are their own worst enemies. Unlike many of our teaching colleagues in other departments who, for Open Days, place textbooks and examples of pupils' work around their classrooms, we science teachers see such events as an opportunity to show prospective pupils that the traditional view of science as, dare I say it, conceptually demanding is mistaken. Indeed, what emerged from discussions with some teachers, who were actively engaged in planning for impending Open Days for prospective Year 6 pupils and their parents, was an acknowledgement that the image of secondary school science that they intended to present was designed to inculcate an image of science as being primarily a fun, exciting and enjoyable *practical* activity:

> Mr Keld: We'll do things that are the most interesting, so we try to sell it. The whole ethos behind Open Evening that is put down from the top of the school, from the SMT [Senior Management Team] through the head of department to us, is it wants to be interesting and good, and good fun.

> Mrs Kettlesing: On Open Evening we always do whiz, bang, pops. The only physics thing we have out is the van de Graaff.
> Researcher: What do you think then of this image of science as being all whiz, bang, pops?
> Mrs Kettlesing: Maybe we're giving a false picture, I think we are probably. There aren't that many whiz bang, pops and most science is really about how does the world work and testing things out, why is this happening, why is that happening, rather than whiz bang, pops.

Mrs Kettlesing, when explaining the rational for such an approach, suggested, "We're trying to make it appear more exciting, I suppose because it isn't exciting all

of the time." When questioned about the use of practical tasks on Open Days a teacher, from another school, expressed very similar views:

> Researcher: Can I ask what you do on Open Days?
> Mrs Uckerby: Do you mean how or what?
> Researcher: What you actually do.
> Mrs Uckerby: Each science puts on a selection of practicals and pupils, and their parents, wander around and try them out.
> Researcher: What type of practicals do you use?
> Mrs Uckerby: We try to use something eye catching and exciting and it's important, I think, that the kids find it fun.
> Researcher: What would you do in physics?
> Mrs Uckerby: I tend to have the van de Graaff out. The kids, and parents love it, although what with health and safety that will sadly probably have to go. But I also like imploding drinks cans and making plasticine boats to support as many coins as possible.
> Researcher: Do you feel that is representative of practical work in general?
> Mrs Uckerby: Definitely not [laughing] but I've got to compete with biology's dissections and, I mean, how often do they do dissections?

The nature of normal school science

Such views suggest that teachers recognise that practical work is not, generally speaking, fun and exciting and that there are only a limited number of practical tasks – the 'whiz' 'bang' 'pops' – that can be used on Open Days, or the like, when such an image needs (or is required) to be presented. The atypical nature of such tasks was also evident in a letter from the head of science, at one of the schools in the study, to head teachers of local primary feeder schools, regarding the itinerary for a Year 6 'Science (Chemistry) in Action Day' in which it was stated that the pupils would spend the day "making Chemical Worms, Bouncing Custard, Chemical Gardens and the *usual* explosions" (Italics added). Whilst it would be possible for the pupils to learn something about the scientific ideas associated with these tasks it seems more

likely, given that the event was actually only to last a couple of hours, that these practical activities were chosen to present a particular image of science; namely that science is essentially hands-on fun activity.

It should be emphasised here that, having been both a teacher and head of physics, I am not suggesting that science is never fun, exciting and enjoyable (far from it) but that such an image does not truthfully reflect 'normal' school science. More importantly it is ultimately an unsustainable image of science since even the most experienced and imaginative teachers amongst us cannot produce fun and exciting practical tasks in every lesson for the five years of compulsory secondary science education. However, as the following example illustrates, some teachers feel that the lack of interest in science, particularly amongst Key Stage 4 pupils, can, to a large extent, be put down to the fact that most of the practical work that they do is simply insufficiently exciting:

> Miss Kilburn: I think a main problem is that we don't do enough exciting stuff and lots of them have got bored by year 10 and 11 just when we'd ideally want them to be switched on to science because they're bored of dull experiments that look at how springs stretch as you add more weight, but that's what we've got to do, it's such a pity really.

In contrast to this view it was suggested by another teacher that it was the quantity, rather than necessarily the quality, of practical work that was important particularly amongst low academic ability pupils who were not expected to pursue science beyond the period of their compulsory education:

> Mr Fangfoss: We try to give them [academically low ability pupils] as much practical work as possible so that they will remember science as being enjoyable and interesting.

Although this view was expressed by only one teacher it suggests that when practical work is used with pupils of low academic achievement the aim might not necessarily be to motivate them to study science beyond Key Stage 4 but simply to provide them with a positive recollection of the subject. The implication, if this view

is taken to its logical conclusion, is that it becomes more important for the teacher to ensure that such pupils simply enjoy their lessons, irrespective of whether they learn or not, and that the best way to achieve this is to maximise the amount of time spent undertaking practical work.

Pupils and their own perceptions of practical work

The fact that pupil interest in science has already begun to decline by the end of Year 7 (Abrahams, 2005; Bennett, 2003; Doherty and Dawe, 1988) reflects the fact, as many of us know only too well, that it takes only a term or two for the novelty of being in a science laboratory and using a Bunsen burner to wear off before even the least astute of our pupils works out that the 'science' of their Open Day bears little, if any, resemblance to the reality of secondary school science.

It is useful, at this point, to consider the reasons pupils give – all reasons are their own – for claiming to like practical work that are presented in Table 2. There are, it emerged, two types of claim: those that might be termed 'absolute' (such as: it is fun, it is exciting, I just like it) and those indicative of a relative preference (containing comparative terms such as; better than, less than, more than) in which practical work is seen primarily as *preferable* to non-practical teaching techniques that they associate, in particular, with more writing (Hodson, 1990). An asterisk indicates a relative preference.

[TABLE 2 GOES HERE]

Of the ninety-six claims, sixty-five (68%) are indicative of a 'relative' preference for practical work, whilst thirty-one (32%) are 'absolute'. Whilst the sample is relatively small it is interesting to note (Table 3) that it was only in the Year 7 group that a majority of pupils claimed to like practical work in an 'absolute' sense. Although time constraints meant that it was not possible to question all of the pupils involved in the study ($n > 250$), there seems no reason to doubt that the responses obtained were representative of the pupils involved in the study as a whole.

[TABLE 3 GOES HERE]

Implications

What this suggests is that having unrealistically raised young pupils' expectations about the nature of science their subsequent disillusionment and disappointment with the reality of school science is all the more pronounced. Indeed, despite our best efforts, a recent report (House of Commons Science and Technology Committee, 2002) clearly shows that the number of pupils pursuing physics and chemistry, in the post compulsory phase of their education, continues to decline – interestingly biology, despite traditionally containing less practical work than its two sister sciences, has managed to maintain its numbers.

This is not to suggest that we, as science teachers, need to give up trying to motivate pupils towards science but that we need to be honest with them. Science is primarily about understanding the real world – and the real world, outside of the school science laboratory, does not contain an inordinately large number of exciting bangs, flashes and pops. If we, as science teachers, try to show pupils that in 'real' science the excitement comes from *understanding* nature, rather than in merely producing phenomena, often in an unthinking "recipe" style (Clackson and Wright, 1992 p 41) manner, then we might in fact succeed in producing a generation of pupils who actually like science for what it really is – an intellectually fascinating subject.

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Table 1

Table 1 School Type

School (pseudonym)	Type	Size	Age Range	Education Authority
Derwent	Urban comprehensive	500	11-16	A
Foss	Urban comprehensive	1480	11-18	A
Kyle	Urban comprehensive	1550	11-18	B
Nidd	Rural comprehensive	890	11-18	B
Ouse	Rural comprehensive	630	11-18	B
Rye	Rural comprehensive	720	11-18	C
Swale	Rural comprehensive	670	11-16	B
Ure	Rural comprehensive	1280	11-18	C

Table 2

Table 2 Pupils' own reasons for claiming to like practical work (Abrahams, 2005 p 272)

Pupils' own reasons for claiming to like practical work	**Number of pupils (N=96) offering such a response**
* Because it is less boring than writing	47
Because it is fun	16
Because you get to make/do things	10
* Because it is better than listening to the teacher	4
* Because you will remember it better	3
* Because it is better than reading from a textbook	3
* Because you learn more	3
Because you can see what happens	2
* Because it helps you understand better	2
Because you get to find things out	1
* Because it is better than theory	1
Because it is exciting	1
* Because it is more believable	1
Because you gain an experience	1
* Because it is better than work	1

Table 3

Table 3 A comparison of 'absolute' and 'relative' responses by Year group (N=96)

(Abrahams, 2005 p 274)

Group	Number of 'absolute' responses	Number of 'relative' responses	Percentage (%) of 'absolute' responses	Percentage (%) of 'relative' responses
Year 7	14	12	54	46
Year 8	8	23	26	74
Year 9	2	7	22	78
Year 10	6	16	27	73
Year 11	1	7	13	87