Untangling what teachers mean by the motivational value of practical work

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ABSTRACT This article reports on a study of teachers' views on the motivational value of practical work. The findings suggest that what teachers frequently refer to as motivation is, in a psychological sense, better understood in terms of situational interest. The fact that situational interest is unlikely to endure beyond the end of a lesson helps to explain why students need to be continually re-stimulated by the frequent use of practical work. The implication is that simply doing more of the same practical work is unlikely to motivate students towards opting to study science in the post-compulsory phase of education.

In countries such as England with a tradition of practical work in secondary school science, its frequent use is seen by many teachers as an important means by which students can be motivated towards school science and, hopefully, science in general. Certainly, this view appears to be supported by the findings of Cerini, Murray and Reiss (2003) who found that students ranked practical work as the third most preferred method of learning science, after field trips and watching videos.

Yet, despite the frequent and widespread use of practical work in English schools (Bennett, 2003), and the common perception amongst teachers that its use motivates (Wellington, 2005), it has been found (Reiss, 2005) that over half of all students (52%) aged 16 and under did not expect to continue with science. Such findings have given rise to a growing concern amongst some within the scientific establishment about the potential impact on the future UK economy of low student participation rates in post-compulsory science education.

It is important at this point to emphasise that the focus of the present study is to examine teachers' views on the affective value of practical work itself, rather than to address the broader issue of what other additional factors influence – positively or negatively – students' subject choices.

While preserving gender, all teachers' names used within the article are pseudonyms.

Research strategy and methods

This study used an approach that involved tape-recorded, semi-structured interviews with 32 teachers in 16 secondary schools across England. The teachers interviewed had a range of teaching experience from that of a newly qualified teacher in their first year of teaching, through to a head of science with almost 30 years' experience in a large department. Teachers were drawn primarily from maintained (state) comprehensive schools (14 schools), although a small number (two schools) of independent (private) schools were also included for completeness. While visits to eight of these schools were arranged as part of a broader study into the affective value of practical work (Abrahams, 2010), the other eight were opportunistic and coincided with visits to schools for the purpose of evaluating the Getting Practical – Improving Practical Work in Science (IPWiS) project. The schools were drawn from a variety of urban and rural settings and were broadly representative of secondary schools in England.

A problem with terminology

Part of the problem in considering the motivational value of practical work relates to the use of terminology. As Bandura (1986) suggests, the problem is that the terms *motivate* and *interest* have been used to mean the same thing even though '*there is a major difference between a motive, which is an inner* ***drive to action****, and an interest, which is a fascination with something*' (p. 243, emphasis added). To avoid this overlap of terminology it is important to clarify what motivation means in a psychological sense and to consider also how the term can be effectively operationalised. For it is important, as Wellington

(2005) makes clear when discussing practical work, to ask precisely '*What does it motivate pupils **to do**?*' (p. 101, emphasis added). It is, after all, quite easy to make general claims about the motivational value of practical work; it is quite another to state unambiguously what such claims would actually mean in terms of specific observable consequences.

Motivation

If, as Bandura (1986) suggests, motivation refers to a drive to undertake some form of action, then there ought to be actions exhibited by motivated science students, as opposed to those lacking in motivation, which can be observed and, ideally, measured. In terms of observable actions, we might reasonably expect these to include: doing more than required for homework (or, at the very least, doing all that we asked to the best of their ability); reading science books/magazines; watching science programmes on television; participating in a science club; viewing science-based websites and visiting places of scientific interest; and so on. However, the most important measure of effective motivation, for those involved in science education, should, we suggest, be the number of students who opt to study a science subject in the post-compulsory phase of their education.

Indeed, it seems reasonable to assume that *if* practical work really motivates students towards science, then the increased use of practical work that accompanied the Nuffield-inspired changes to the curriculum during the 1960s ought to have generated an *increase* in the number of students pursuing science subjects post compulsion. This, as Hodson (1990) has noted, did not occur, and at a time when Nuffield-inspired changes to the curriculum might have been expected to increase the uptake of science at A-level, the number of students pursuing science at this level actually decreased.

However, we need to appreciate that there may be many other things, such as poor teaching, the perceived lack of relevance of science to students' lives and the inherent difficulty of the subject itself, that could potentially outweigh the positive effect that practical work might have on students' subject choices post compulsion. Furthermore, there is also the need to recognise that the educational system in England, in which students are required to specialise by the age of 16, must result in some students not pursuing their study of science because of positive choices in favour of other subjects, rather than negative views of, or a lack of motivation towards, science.

Yet the old adage that 'actions speak louder than words' lends credence to the claim by Bennett (2003) that, while certain practical tasks can generate interest and/or engagement within a particular lesson, there is little evidence to suggest that they motivate students towards science in general or, more importantly, towards the further study of one (or more) of the sciences in particular.

Personal interest

Personal interest, sometimes referred to as 'individual' interest, is primarily concerned with the relative ranking of an individual's preferences. As Bergin (1999) makes clear, the '*individual approach* [to interest] *asks what dispositional preferences people hold, or what **enduring** preferences they have for certain activities or domains of knowledge*' (p. 87, emphasis added). Studies in the area of personal interest have found that children who undertake a particular activity, or study a subject, in which they already have a personal interest will, relative to children with no prior personal interest, be observed to pay closer attention to, learn more from, and engage for longer with any new material that they are presented with. The relationship between personal interest in and knowledge of a subject or activity arises because individuals prefer, when given a choice, to study what already interests them (Bergin, 1999). By increasing their knowledge of that subject or activity they increase their personal interest in it, further developing what might usefully be thought of as a system of positive feedback.

Numerous factors can stimulate personal interest. Bergin (1999) suggests relevance, competence, identification, cultural value, social support, background knowledge and emotions, all of which are, generally speaking, beyond a teacher's immediate domain of influence. However, while personal interest can be an important factor in effective learning, it is not something that is, in the short-term, susceptible to teacher influence (Hidi and Harackiewicz, 2000).

Situational interest

Situational interest refers to the interest that is stimulated in an individual as a consequence of being in a particular environment or situation

(Bergin, 1999), such as when a student undertakes practical work in a science laboratory. If practical work were generating situational interest, we would expect, as the following example of the sort of comments students made to us illustrates, that students would make positive claims about practical work while expressing little, if any, inclination to pursue the subject post 16:

Student (aged 15): *I really like practical work, it's good fun*.

Researcher: *Oh, so are you going to study a science after your GCSEs?*

Student: *You must be bloody joking sir*.

Interestingly, many of the teachers, when asked why they believed that practical work motivated their students, suggested, as the following examples illustrate, that they saw student claims about liking it as evidence of its motivational value:

Mr Drax: *Practical work, yeah I think it* [practical work] *motivates them. The number of children that come in and the first question they'll say is 'are we doing practical today?'*

Dr Kepwick: *It* [practical work] *motivates them, they ask 'Are we going to do some practical today Miss, are we going to do some practical?*'

Unlike personal interest, situational interest is susceptible to teacher influence in the short term (Hidi and Anderson, 1992). Yet, while it therefore provides an opportunity for teachers to influence the effectiveness of student learning in specific lessons, its effect is less likely to endure over time (Hidi and Harackiewicz, 2000).

It should also be recognised that, while students claim to like practical work, such claims do not necessarily mean that they are in fact interested in it. This is important in that, while a necessary condition for *personal* interest in a subject or activity is that the individual concerned also likes that subject or activity per se (Schiefele, 1991), 'interest in' and 'liking of' a subject can, in the case of *situational* interest, arise independently of each other (Hidi and Anderson, 1992).

Are teachers, we might then ask, using the term motivation in its strict psychological sense or more as a 'catch-all' term that embodies elements of interest, enjoyment and engagement?

Teachers' views

Many of the 32 teachers interviewed introduced the terms 'motivate', 'motivation' and 'motivating' without being prompted to do so in any way. The following example, which is illustrative of many of those we recorded, shows how one teacher used the term 'motivating' in response to a question about the extent of their use of practical work:

Researcher: *To what extent do you use practical work in your lessons?*

Mr Rainton: *I try to use practical work as often as possible because I think it's great at motivating the kids.*

Yet, when asked to clarify what he meant by his use of the word 'motivating', this teacher suggests that:

I think in most instances it's short-term engagement for that particular lesson rather than general motivation towards science. In general I think it's very difficult to motivate kids in years 10 and 11 [aged 15–16] *into thinking about engaging in science and thinking about science in terms of 'that's a career that I want to follow'.*

What the above example illustrates is that the term 'motivation' can be, and in this study often was, used by teachers more as a 'catch-all' phrase for the affective value of practical work in general rather than in a strict psychological sense.

Therefore, while teachers often spoke about what they saw as the motivational value of practical work, when this was explored more fully during the interviews it emerged that the psychological characteristics of this 'motivation' were more closely associated with those of non-enduring situational interest. So, for example, while many teachers cited as evidence for the motivational value of practical work the fact that students often entered their science laboratory asking to do practical work, they also frequently reported, as would be expected in the context of situational interest rather than genuine motivation, that the absence of practical work, even for only a few lessons, made students (often those who had requested to do practical work previously) much more difficult to manage from a behavioural perspective:

Mrs Wharfe: *I think you can tell that it* [practical work] *motivates them because the first question they'll ask as they come into the lab is 'Miss*

are we doing a practical today?' and if I say yes they're just so pleased but if I say no they're really disappointed.

Researcher: *If you say no do you really think they're disappointed? I mean you said earlier that you try to do a lot of practical work anyway so not doing a practical isn't really a big deal for them is it?*

Mrs Wharfe: *You wouldn't think so, I know, but I think they expect science lessons to be practical and they can start to play up, especially the lower sets, if they think they aren't doing enough* [practical work].

Researcher: *When you say play up what do you mean?*

Mrs Wharfe: *I suppose they just don't settle, there's a lot more 'oh Miss this is boring' sort of comments. I suppose they just don't like not being able to do things and having to write, so they can play up.*

Although, in this respect, one teacher saw the use of a laboratory itself, especially for non-practical science lessons, as problematic in the sense that laboratories, unlike classrooms, are essentially designed, with their uncomfortable stools, and benches containing sinks, power points and gas taps, for *doing* rather than sitting and writing:

Miss Sharow: *I think the whole thing generates an expectation for practical work* [gestures around the laboratory], *just the lab, you know, the gas taps, the water taps. So when they come in and it's not a normal classroom, you know. If they were sitting in a normal classroom, you know, they'd be thinking, you know, 'all right, we're not going to do practical because there's nothing to use'. Whereas they come in here and see all the equipment out at the back* [points to equipment at the back of the laboratory], *gas taps and, you know, I think being in the lab raises expectations of practical work.*

Certainly this raises an interesting question for future research as to whether timetabling the overwhelming majority of all science lessons in laboratories inculcates an unreasonable expectation amongst students that science is essentially just about doing.

Interestingly, the situations in which the term motivation was used in a correct psychological sense occurred when seven of the teachers interviewed linked a recent increase in the number of their students choosing to pursue science post compulsion with an increased level of motivation towards science, which they attributed to their use of a more context-based approach to teaching science. As the teacher in the following example illustrates, the improved student motivation, as measured by an increased uptake of science post 16, occurred despite the perception amongst some of his science department colleagues that the new approach contained *less* practical work:

Mr Teise: [This new syllabus] *it's really motivated the kids here. I mean we weren't sure to start with, you know, introducing a new GCSE, but our A-level numbers* [in science subjects] *were really weak and so we thought we'd try something totally new and now uptake at AS* [in science] *has gone through the roof. I know some of the kids don't like all the discussion bits, and some colleagues say there's less practical than they're used to, but it's certainly turning more kids on to sciences which is no mean thing to do.*

While these numbers are too small to make any strong claims, it does suggest that these teachers measured the motivational success of the new syllabus in terms of the noticeable impact it has had on student science numbers post compulsion. This specific linkage of motivation, with increased uptake post compulsion, did not emerge spontaneously when teachers were asked why they believed practical work motivated their students. Indeed, as the following example illustrates, many of the teachers in the study were, when specifically asked, disappointed that despite their frequent and sustained use of practical work this appeared to have little impact on the number of their students opting to study science post compulsion:

Researcher: *How many of your students go on to take a science at A-level?*

Mrs Witham: *Do you mean at AS or A2?*

Researcher: *Either.*

Mrs Witham: *Very few, particularly in the physical sciences. It's disappointing because we use lots of practical and yet when they choose their subject so many opt for geography, history or English, none of which do anywhere near as much practical as we do.*

Conclusion

This article has suggested that what teachers frequently mean by motivation is better

understood as situational interest. The fact that situational interest, unlike motivation, is unlikely to endure beyond the end of a particular lesson, helps to explain why students need to be continually re-stimulated by the frequent use of practical work. Once this is recognised, it becomes clearer why many of those students who teachers feel are motivated towards science, because of their claims to like practical work before or during a lesson, opt not to pursue it post compulsion. While these students might like practical work, their reasons for doing so might owe less to a motivation towards science and more to their desire to avoid writing (Hodson, 1990).

The implications of these findings for practice are significant. First, there is a need for greater clarity and consistency in the use of affective terminology. Claiming that students find doing practical work motivating, when what is actually *meant* is that students find doing practical work fun, means that we unrealistically inflate the affective value of practical work. Second, teachers need to recognise that an apparent enthusiasm amongst students towards practical work does not necessarily imply an enduring motivation towards school science or science more generally. Indeed, however much it might bruise our egos to accept this, such an apparent enthusiasm might owe more to their desire to avoid writing, sitting still or listening to their teacher, than to our having motivated them towards school science. Third, the average 32% increase in the number of students who opt to pursue science post compulsion after following the *Twenty First Century Science* suite of GCSEs (University of York, 2009) shows not only that it is reasonable to expect an increase in student motivation to manifest itself as an increase in the number of students opting to pursue science post compulsion, but that increased motivation is not inextricably tied to the use of ever-more practical work.

The account above is a brief overview of the main findings of this research study. For a fuller account, see Abrahams (2010).

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