Consultation on supplementary subject specific guidance for inspectors for science.

An Institute of Physics response to Ofsted.

A full list of the Institute’s responses and submissions to consultations can be found at http://www.iop.org

29 July 2010

The Institute of Physics is a scientific charity devoted to increasing the practice, understanding and application of physics. It has a worldwide membership of over 37,000 and is a leading communicator of physics-related science to all audiences, from specialists through to government and the general public. Its publishing company, IOP Publishing, is a world leader in scientific publishing and the electronic dissemination of physics.

The Institute welcomes the opportunity to submit a response to Ofsted on the supplementary subject specific guidance for inspectors of science.

Our response highlights a number of the Institute’s concerns about the criteria in the hope that they can be made more subject-specific, accommodate all learners and present a clearer view of good teaching and learning in physics including the role of practical work, knowledge and understanding and ideas about the sciences.

Prof. Peter Main
Director of Education and Science
Overview

1. Many of the statements still seem very generic; this is particularly true of the first sentence in each level descriptor. Indeed, a quick glance at the guidance for other subjects shows that there is a lot of overlap. It would be more useful to keep common statements in the generic column and reserve the right hand column for statements that really are subject-specific and describe distinct aspects of the subject.

For example, the two sets of statements below are from the ‘good’ descriptors for achievement in Science (italics) and RE – two quite different subjects:

*Pupils are able to work independently when given the opportunity, taking the initiative in individual work and when working with others.* . . .

Pupils are able to work independently when given the opportunity, taking the initiative in their work and when working with others.

*They demonstrate some originality in their approach, coming up with new ideas . . . . They show imagination . . .

They demonstrate some originality, imagination or creativity in their subject work . . .

*They enjoy the subject and as a consequence apply themselves well . . . They are able to explain its value . . .

They enjoy the subject and can explain its value . . .

We would like to see the subject-specific descriptors reflecting the character of (in this case) the sciences. It ought to be that the descriptor is still recognisably about the sciences even if the word ‘science’ is removed from it.

2. All the statements refer to science. We would like to see acknowledgement that there are three separate science disciplines in schools rather than a single subject called ‘science’. Therefore, we would encourage the document to refer to ‘the sciences’ rather than to ‘science’. This encourages an interdisciplinary approach rather than an integrated one. Interdisciplinary work is strengthened by the recognition and identification of the distinctive elements of each of the sciences.

3. Furthermore, there are some aspects of teaching and learning in the sciences which are distinct to each discipline. The subject-specific criteria should require inspectors to recognise different things in physics, chemistry and biology lessons or topics.

4. There is no reference to how the teaching is relevant to the age, ability or needs of the pupils; nor is there reference to the context of the school. All of these should be taken into account under all of the headings.
5. The view of the sciences (and the teaching and learning of them) is unrealistically narrow; it seems to be based on investigations, team work, relevance, creativity (and originality) and enrichment activity. All of these are important aspects of being a rounded citizen and can contribute to being a good scientist. But, by themselves, they are restrictive and lose much of the character of what it is to be good at the sciences. There is more to practical work than investigations and more to physics than teamwork, innovation and originality.

6. Our comments (in paras 23, 33, 40 and 41 below) deal with references to innovation. We can see that the purpose of requiring innovation is to discriminate against a teacher that uses the same materials and approaches for decades on end, which is fine. However, perhaps the key point is that the teaching is informed by personal reflection and external CPD; so it would be more useful for inspectors to look for evidence of involvement in CPD, engagement with professional bodies and the ASE, attendance at conferences, participation in discussions and subscription to journals or magazines about subject pedagogy.

Achievement

7. There exist National Curriculum level descriptors for the sciences. It is odd that inspectors are being asked to measure pupil achievement and yet there is no reference to the level descriptors.

8. There is no reference to pupils’ prior achievement or their ability. There should be some measure of students’ progress and added value during a key stage. Given that inspectors can see a small lesson sample, a more reliable way to measure achievement would be through contextual value added scores in each key stage.

9. We would like to see inspectors taking note of progression rates to A-level and, where appropriate, higher education. To be graded as having ‘good’ or ‘outstanding’ achievement, departments should be able to show success in getting students to choose the subject. Again, this would need to be put in context for the school and in a national context.

10. The subject-specific descriptions have very little within them that is recognisably physics (or any of the sciences). For example, the descriptor for ‘good’ deals with, in order: independent learning, SC1-type investigations, research, having new ideas, making hypotheses, working hard because they enjoy the subject and an understanding of science in society.

11. There is no statement in here that allows inspectors to measure students’ ability or progress with knowledge, ideas and skills that are recognisably physics (or
any of the other sciences). Inspectors should look for students’ ability to analyse
and solve problems, to use models to explain the physical world and make
predictions, and to use reasoning that is mathematical, based on logic and uses
the coherent structure of physics.

12. There is a very narrow view of practical skills – based on an old view of SC1
(hypothesis, prediction and investigation). There is no reference to essential and
enabling practical skills; for example the ability to wire a circuit.

13. There is an odd emphasis on originality. Why do students have to come up with
new ideas on how to tackle a problem or display data? Of course science is
about innovation; but, firstly, we cannot expect every lesson to provide
opportunities for students to innovate; secondly, how original can students be in
this context? Presenting data effectively and correctly in a tried and tested way
seems an entirely appropriate measure of ‘good’ achievement.

Quality of teaching

14. Again, there are some generic statements here. For example “Teachers
communicate high expectations, enthusiasm and passion about [their] subjects
to pupils”. These do not need to be in the subject specific column.

15. We welcome the reference to having good subject knowledge. However, it could
be strengthened. Teachers should have a very secure knowledge of the subject
that they are teaching and be able to field questions about the topic or the
subject that are outside the lesson objectives. At the lowest level (4), it may be
obvious that teachers avoid tricky questions to the extent that their lessons are
hindered substantially – particularly if they are outside their subject specialism.

16. We would like to see some reference to teachers providing explanations rather
than description; and for teachers to demonstrate what it means to think like a
physicist; for example, to analyse and solve problems, to think things through
from first principles and to use models to predict and explain patterns.

17. We would like inspectors to look for evidence that teachers have considered
how they will teach physics so that it will appeal to girls. There is a range of
strategies, some of which may be seen during the inspection. But, at the least,
teachers should be able to show they have thought about the problem of fewer
girls following physics beyond the age of 16.

18. Inspectors can look for evidence of success at encouraging girls to take physics.
The national proportion of A-level students is 22%. Where schools have good
overall progression rates to A-level, the proportion of girls can be compared
against this percentage, bearing in mind any issues with the statistics of small
numbers.
19. Teachers should provide consistent, coherent explanations and narratives about physics ideas. There is a coherent narrative thread within a lesson and this lesson fits into a broader structure of understanding. At a higher level teachers develop ideas to engender understanding – they will develop them from earlier ideas, pupil experience or practical work. The new ideas will be consistent with the rest of students’ experience of physics. At lower level ideas will be presented without development, often in a confusing way and they may appear contradictory with other areas of physics.

20. In good physics lessons, teachers will put meaning into matter: they will be seen to use apparatus as an interactive resource to enliven explanations and connect the theoretical world to the lived-in world; and they will talk through ideas making use of apparatus for illustration.

21. There should be evidence that apparatus is used frequently in lessons for purposeful practical work.

22. There are some preliminary statements that seem unnecessary; for example (in level 1), “They have a very clear understanding of how science is learned best”. This is very hard to achieve and is the subject of much educational research. The sentence is followed with a list of some example activities – which are all fine. The key here is that they use a range of activities and choose appropriate activities for a given situation. But they can do this without the ‘clear understanding etc.’ that is being asked for. We suggest removing the preliminary statement.

23. There is extensive emphasis on innovation. Is this truly necessary for good or even outstanding teaching? It is better to include varied and appropriate strategies in lessons.

24. We would rather see some expectation that teachers reflect on their practice.

25. The references to practical work should go beyond investigations. Teachers should use high quality practical work in a number of ways including (but not limited to): demonstrations, class practicals, field work and using the school grounds.

The curriculum

26. We welcome the fact that the curriculum is expected to match the needs of all pupils. This expectation should be reflected in the teaching and achievement as well.

27. We would like to see statements that allow inspectors to look for evidence of useful and interesting content and contexts for each of the sciences. In
particular, we would like schools to be credited if they offer opportunities for teachers to get students to think like a physicist (see 16 above).

28. The curriculum should cover a core of ideas in physics that will allow for (and encourage) progression to the next level.

29. The curriculum should comprise a series of coherent narratives that develop the learners’ knowledge and understanding of physics (and the other sciences).

30. It should show that physics has been very successful at describing the physical world and that ideas in physics are interlinked and consistent with each other.

31. There should be opportunities for teachers to show that physics provides models with the power to predict results that can be tested.

32. The curriculum content should be structured in a logical sequence so that students realise that there is a rationale behind physics ideas (i.e. they derive and discuss ideas and theories rather than presenting them as knowledge to be learned).

33. It is not clear what is meant by ‘current initiatives’ and why a ‘current’ initiative is necessarily a good thing. It is more important that it is informed by evidence of what is good practice than current initiatives. Tried and tested ideas can be as good as or better than ‘current initiatives’.

34. A third of each of the paragraphs for the top two levels is devoted to enhancement and enrichment including examples and how it might be used. This does not seem balanced given that there are no examples of useful content or what is good practice for including practical work.

35. We would like to see greater inclusion of learning outside the classroom - not just visits, but also to include some of the wider aspects of what is meant by this. E.g. using the school grounds; field trips etc

**Leadership**

36. We welcome the reference to high quality CPD in the subject.

37. A good, well led department will have an obvious culture of physics (and chemistry and biology) and a buzz and enthusiasm for the subject. We would like to see inspectors looking for evidence of a culture of physics within the department.

38. There should be good technician support.

39. There is no mention of apparatus in the guidance. A good department will have a well-stocked prep-room; there will be evidence of investment in keeping
apparatus maintained and up to date; and there will be a good supply of scientific consumables (chemicals, batteries etc).

40. Again there is a reference to ‘initiative’; this time they should be ‘cutting edge’. It isn’t clear that a department that employs ‘cutting edge initiatives’ will be better led than a more settled department. Indeed, the need to be cutting edge is likely to result in instability.

41. Similarly, it isn’t clear that a “strong track record of innovation” will necessarily result in better leadership.

42. We would like to see evidence that the school values subject knowledge and supports CPD to maintain good subject knowledge of all teachers teaching physics.

43. There should be evidence that the school maintains (or has attempted to maintain) a balance of subject specialists in the science department. This could be through recruitment or through retraining staff (for example, on SASP course). In particular, there should be at least one physics specialist and enough physics specialists to cover all the Key Stage 4 and post-16 teaching.

44. The leadership team should be encouraged to allocate subject specialists to teach physics, chemistry and biology – particularly at Key Stage 4.

45. Additionally, at Key Stage 4, leaders should be encouraged to ensure that all students are taught physics (and the other sciences) by a subject specialist.

46. We would like to see physics having a recognisable and distinct identity at Key Stage 4 whether as part of Additional Science or GCSE physics.