Teachers' professional development standard

A response to a Department for Education consultation on behalf of the Association for Science Education, Institute of Physics, Royal Society of Biology, Royal Society of Chemistry and The Royal Society

16 October 2015

The Association for Science Education, Institute of Physics, Royal Society of Biology, Royal Society of Chemistry and the Royal Society work in partnership to ensure that policy supports and promotes high-quality science education in schools. We use our combined expertise and united voice to advocate evidence-based and informed science education policy. This joint response is submitted on behalf of all five organisations.

We have considerable experience in professional development activities in the sciences. We have been linking with teachers and running professional development opportunities for over 20 years and in some cases much longer. We continue to lead CPD ourselves and work with CPD and ITE providers (see appendix 1).

1. We believe that science education should prepare students to be informed and engaged citizens, stimulate interest in the further study of the sciences and educate the next generation of researchers and science professionals.

2. The quality of teaching is the most important influence on students' learning, their achievement and their decision to pursue further study in the sciences.

3. High quality ongoing professional development is needed to ensure that all teaching is of the highest quality, and to support and develop a workforce of great teachers. This is true at all stages of schooling, and across all subject areas.

4. A culture change is needed so that developing great teachers is seen as part of the role of the school (as employer) that benefits the teachers, the students, the education system and the nation.

5. A new standard for teachers' professional development can contribute to this shift by encouraging teachers to make professional development an essential element of their professional role, and by helping teachers find high quality professional development opportunities.

6. The standard should also provide clear and direct guidance for schools and school leaders about their responsibilities in this area, including planning the professional development of all staff.

7. The standard should provide a clear set of expectations for professional development leaders to use in developing their programmes, and to help them demonstrate effectiveness.

8. The standard should promote rigorous evaluation of professional development activities, and encourage schools and teachers to make use of that evidence in their decision-making.

9. The standard should recognise the importance of subject-specific professional development, including both subject-specific knowledge and pedagogic content knowledge. The standard should specify a minimum number of hours per year to be dedicated to subject-specific professional development. A good starting point for determining this minimum is to consider the annual CPD requirements for professional recognition in teaching and other professions. Subject-specific professional development, including for teachers working outside their subject area, is particularly important in the sciences.

10. The standard should also recognise the value of teachers working together to ensure that new approaches in science pedagogy can be adapted to local contexts.

11. Professional development leaders should also have a strong foundation of subject knowledge in the subject areas they provide for. As chartering organisations, we would expect CPD leaders to have sufficient subject knowledge and expertise to be eligible for chartered status in the subject(s) relevant to their CPD, and we would expect CPD leaders to work towards that status where possible.

Question 1

Can you give an example of great professional development practice with which you were involved, which had significant impact on pupil outcomes? If you can, describe what the participants did, what the school did, and what the external expertise was.

12. Our response to this question is necessarily adapted – we are not schools. However, as noted above, we have an interest in the quality of CPD provided to develop our disciplines and we have much experience, directly and through our members, of providing and taking part in teacher CPD. We also attend the major teaching related conferences and run workshops, offer advice and supportive education literature. We work closely with teachers to ensure that CPD is fit for purpose, timely and accessible.

Types, formats and activities of CPD

13. Types of CPD: as many people will note, there are many types of CPD including: trainer-led events, workshops, day meetings, reading books, watching videos, asking or answering questions in on-line forums and/ or on an e-mail discussion lists, academically qualifications (e.g. Masters) etc.. The important aspect of all of these is that the participant reflects on the implications for their own practice and on opportunities to apply new learning within or after the event[1].

14. Format of CPD: the format of trainer-led, face-to-face CPD can be varied and includes: whole department workshops (either in-school or in another school), a single teacher working with a colleague or going offsite (possibly to a training facility), residential courses for one or more teachers, one-off events or programmes that involve several days over a period of time.

15. Domains of CPD: the main domains of CPD are professional practices and subject specific CPD – which will incorporate subject knowledge and pedagogic content knowledge (PCK). These two overlap a lot. What is important is that teachers consider how they have learnt and understood subject ideas and how they might overcome barriers that could hinder their students' learning[2].

16. In this response, the emphasis will be on subject-specific CPD – in its various types. Subject-specific CPD is essential in the sciences to keep teachers abreast of developments within the discipline and also with our increasing understanding of how children acquire knowledge and develop understanding in the sciences, and what pedagogy can support this. Subject-specific CPD must also support and develop the subject knowledge of those teaching outside their discipline[3].

17. There are a number of attributes of CPD that can make it successful and effective. Any given event does not have to have all of these and lacking any of them does not mean that the CPD will not be effective. Many of these elements are as integral for CPD that is self-directed as

[1] CIPD. *What is reflective learning?*: http://www.cipd.co.uk/cpd/reflective-learning.aspx

[2] Shulman, L. (1987). *Knowledge and teaching: Foundations of the new reform*. (Harvard Educational Review, 57 (1))

[3] Scott, P ret al (2010). *Impact of focused CPD on teachers' subject and pedagogical knowledge* : https://www.sciencelearningcentres.org.uk/media/filer_public/dc/ab/dcab2366-6829-47dd-a40c-235fc1fda76d/leedsimpactfocussedcpd2010.pdf

for CPD led by a provider or coach. However, from evidence that we have collected through our own work, the attributes of successful CPD include:

a) Having some external, expert input[4]. CPD should provide teachers with tools that go beyond 'this worked for me last week'. CPD leaders should have secure knowledge of the area that is being discussed or developed. In subject-specific CPD, leaders clearly need a very sound knowledge and understanding of the discipline, as well as the ability to transmit this knowledge effectively to teachers.

b) Having a link to research and evidence. There are many different ways to teach something. However, there exists evidence and expertise about the consequences of teaching ideas in certain ways and CPD providers should be able to discuss these in depth with participants. CPD should also ensure that teachers are able to bring out an understanding of students conceptual development, including addressing any naïve ideas that children have ('misconceptions'), and be able to meet different students' needs.

c) Participation and use of language. It is essential that teachers are able to *participate* in the CPD. CPD should be a two way process[5]. Language is important in supporting this approach. To support a cultural change to attitudes around CPD, the terminology should shift from teachers 'attending' CPD to 'participating in' CPD so that they become 'participants' rather than 'attendees'; and away from providers 'delivering CPD' to 'leading or running' CPD events.

d) Community building. It is important that teachers have opportunities to network with other teachers (at events or on line[6]) so that they can build self-supporting networks. These networks (whether transitory or permanent) help teachers to reflect on their practice – especially as it pertains to a shared event.

e) A relationship with the CPD leader. This is especially true when working with subject-specific CPD. Teachers are more likely to trust their coach or CPD leader and risk exposing their weaknesses if they have a relationship with the individual. This relationship will be much easier to develop if the CPD leader has had teaching experience themselves. Another advantage is that the relationship allows the coach to get to know the needs of the individual or department.

f) Having a bespoke element. CPD is only effective when it is tailored to the needs of the participants, taking account of where they are in their development, their experience to date, their existing conceptions about the topic of the CPD and what their current timetable allocation is. In one-off events, it is important that providers diagnose and discuss the needs of the participants before the start of a session to tailor the session. Participants themselves should also have some influence over the CPD in which they take part, and not just their school. This preparation will help ensure that the CPD meets their needs.

[4] Teacher Development Trust (2015). *Developing Great* Teaching: http://tdtrust.org/about/dgt/
[5] Babcock (2012). *Evaluation of Stimulating Physics Network Phase 2*: https://spt.app.box.com/SPNEvaluation/1/1344060240/12004648756/1
[6] These include: talk biology, talk chemistry, talk physics, PTNC, Strontium, Synapse, Sputnik.

g) In school with a department. Working with whole departments on Pedagogical Content Knowledge (PCK) is very powerful. It embeds practice, builds trust, allows for mutual support and relates directly to the school's needs and activities. There are opportunities to build the change into schemes of work and the change is more likely to be implemented and embedded.

h) Sustained. Subject-specific CPD that is sustained tends to have bigger impact. This might be an on-going one-to-one contact with a provider after an event or may be part of a series of events. Returning to ideas (of the subject and PCK) after teachers have had the opportunity to use these in their own classrooms) can help teachers bring ideas together and reflect on their learning

i) Challenging but supportive. It is important that teachers are challenged on their existing practices and, in some cases, their understanding of the subject. However, this must be done in a supportive and trusting way.

j) Based in practice. Any CPD is more likely to have lasting impact if it is linked to or based in the classroom practice of the teacher in teaching their subject.

Links between professional development, pupil outcomes and/or career development

18. Student performance is important. However, there is a risk in linking CPD too closely with 'pupil outcomes'. Particularly if that means a narrow focus on isolated metrics, such as immediate improvement in exam results - which is a tempting measure for school leaders. We often hear of those school leaders asking the question: how will this CPD increase the performance of my students? If student exam performance becomes the driving and *only* measure of their outcome, then this is likely to narrow the types of CPD that are encouraged: the CPD will become very exam-focused to the extent where there have been examples of teacher CPD comprising a set of hints to ensure success for their students in an assessment.

19. A more holistic view of student outcome is the depth and lasting impact of their learning, their enthusiasm for a subject, the likelihood that they will choose to take it at the next stage and whether they are well prepared for their next step. Positive effects on these student outcomes are more likely with a well-trained, satisfied and stable workforce. That is, teachers are well-versed in their subject, how best to teach it and are enthusiastic and satisfied in their work – becoming more likely to remain in the profession for a number of years (gaining experience for themselves and that they can share). And such a workforce is more likely if all teachers have regular access to high quality CPD that has a lasting and deep benefit on the professional practice of the participant.

20. It is worth emphasising the point from the paragraph above that an important part of high quality CPD is improved retention of teachers. This is both good for the quality of teaching (retaining the experience[7]) and also cost effective (obviating the need to recruit and train so many new teachers).

[7] Wolstenholme, C., Coldwell, M. and Stevens, A. (2012). *The Impact of Science Learning Centre continuing professional development on teachers' retention and careers: final report*. (Sheffield: CEIR): https://www.sciencelearningcentres.org.uk/media/filer_public/7a/e1/7ae12f3e-030b-4e5f-b27a-41b04cddeb46/shu_retention_full_report.pdf.

21. In summary: teacher retention matters; teacher morale matters; teacher capability matters. CPD supports those attributes and improved pupil outcomes are more likely to result from them.

How professional development activity is evaluated

22. Most CPD is evaluated through questionnaires and surveys. These can be helpful in determining immediate satisfaction. However, it should be noted that this method does not measure lasting impact.

23. Another useful measure of the quality of CPD is the rates at which people return to the same provider. That is, with repeated or sustained CPD, the number of teachers who keep coming back.

24. One recent report[8] measured teachers' own views on how their professional skills had changed over a number of years; this perspective and methodology are worth considering as one means to evaluate professional development.

25. More rigorously, with some interventions, it is possible to use the National Pupil Database (NPD) to look at longer-term changes in uptake and progression rates to later study in the subject[9]. This is a helpful and nuanced measure: if the progression rate improves after an intervention with teachers, it shows that more students in a year group have been sufficiently successful and more enthused than previously to the extent that they chose to continue with the subject. It is therefore likely that *all* the students benefitted from better teaching with improved experiences and outcomes (in a holistic sense) – even though they did not study the subject at A-level.

26. It is also possible to use the NPD to look for improvements in exam performance – noting that this should not be the only or the driving metric (see paragraph 25 above).

27. There is increasing use of RCTs to look at the effect of CPD. The Wellcome Trust and Education Endowment Foundation have each run a number of RCTs in education and they appear to yield useful information.

[8] TNTP (2015). *The Mirage: Confronting the Hard Truth About Our Quest for Teacher Development*: http://tntp.org/assets/documents/TNTP-Mirage_2015.pdf

[9] Institute of Physics (2013). *The Stimulating Physics Network: A Report on Impact*: https://spt.app.box.com/SPNEvaluation/1/1344058938/12004734458/1

Question 2
How could the standard help to promote effective professional development practice which has a positive impact on pupils' education?

What elements of teachers', school leaders' and professional development providers' practice should the standard emphasise?

For teachers

28. The standard should emphasise a requirement for teachers to undertake a tailored CPD programme that develops their competence and confidence in all aspects of their role – including subject-specific knowledge and other aspects. No single course can provide enough evidence for the standard; it should be evidenced from a number of formal and informal professional development activities. The process of developing classroom practice should be seen as on-going for a teacher's whole career.

29. The standard should relate to CPD that addresses the professional practices of teachers as well as administrative or procedural requirements at a school level. It should emphasise that CPD should be in the context of teacher's teaching of the subject. Over time it should lead to the increased professionalisation of the teacher, taking increasing responsibility for their own development

30. The standard should address teachers' subject knowledge and pedagogic content knowledge. It should require that teachers are educated to teach the subjects that they teach at the levels that they teach them. Currently, any teacher with QTS can be deployed to teach any subject – whether or not they have been trained in that subject. This has a particular effect in the sciences where it is assumed that a graduate of one of the sciences with a PGCE in that same subject has the subject knowledge to teach topics in any of the sciences to GCSE level.

31. Teachers should have reached a threshold of subject knowledge and PCK in each subject that they are teaching at the level that they are teaching it. They will begin the process of developing this knowledge during their initial teacher education – as part of QTS – indicating that QTS is the beginning of their development as a professional rather than the end of it.

32. During their career teachers CPD can help teachers develop the subject knowledge and PCK needed to teach other subjects (or at higher levels).

33. Reaching this threshold level of subject knowledge and PCK should not be seen as the end of teachers' professional learning. Even once they have reached a threshold, they should be encouraged to continue to develop their subject-specific and pedagogic skills.

34. These requirements will contribute to developing a culture of professional development amongst teachers.

35. The professional bodies (and HEI's) can play a part in certifying teachers' subject knowledge and PCK at different levels.

36. There should also be a requirement to keep up to date – through CPD – with other aspects of their professional practice.

37. There will be different phases (that might be regarded as acquiring knowledge for practice, knowledge in practice and knowledge of practice[10]). During those different phases their requirements from and interaction with CPD may change. However, the important aspect is that it continues and teachers keep on getting better.

For schools

38. Schools should take responsibility for ensuring that their staff are trained (through their initial teacher education or CPD) to teach the subjects and lessons that they are deployed to teach.

39. Schools should have up-to-date records of the detailed qualifications of their teachers – what subjects they are qualified to teach at what levels. It may be that the teacher only gains experience of Key Stage 3 and Key Stage 4 during their ITE. They should be able to demonstrate that they are deploying staff to teach subjects that they are qualified to teach at a level that they are qualified to teach them.

How could the standard most effectively balance supportive guidance and constructive challenge for teachers, school leaders and professional development providers?

40. It is helpful for early career teachers to have an induction programme[11] and a subject mentor[12] – possibly an external mentor. Their mentor can help them, in a non-judgemental but challenging way – to develop their subject specific skills[13]. This is quite different from a school-based teacher mentor or manager.

41. Teachers (especially early in their career) benefit from being a part of a subject-based community where they can share problems and discuss solutions in a safe environment. They should be encouraged (through recognition) to join local and national networks of support (including on-line groups).

How could the standard encourage an evidence-informed approach to professional development?

42. It is essential that CPD interventions are tested against rigorous measurable and realistic outcomes, including broader and longer-term measures, and that schools select their CPD programmes using the available evidence.

43. One of these is the impact on students – which (for CPD in secondary schools) includes progression rates to the next level in a subject, the diversity of students progressing to the next level and the achievement of students.

44. Another is the retention of teachers (within a school or within the teaching professions).

45. In all cases, the system needs better quality data with greater coverage.

[10] Lieberman, A and Miller, L, Eds. (2001). *Beyond Certainty: Taking an Inquiry Stance on Practice, in Teachers Caught in the Action: Professional Development that Matters* (Teachers' College Press)

[11] Smethem, Lindsey and Adey, Ken (2005). *Some effects of statutory induction on the professional development of newly qualified teachers: a comparative study of pre-and post-induction experiences* (Journal of Education in Teaching, 31 (3))

[12] Simon et al (2011). *Characteristics of effective professional development for early career science teachers* (Research and Science in Technological Education, 29 (1))

[13] Gatsby Foundation (2012). *The nature, impact and potential of external mentoring for teachers of physics and other subjects in England*: http://www.gatsby.org.uk/uploads/education/reports/pdf/gatsby-summary-impact-of-mentoring.pdf

46. In school or department level interventions, the NPD can provide important measurements on whether the intervention has improved student outcomes[14].

47. For smaller interventions, the data can be recorded to determine the cumulative effect of professional development on student outcomes. This would mean keeping up-to-date and transferable records of teachers' CPD and certifications and data on the deployment of those teachers. Those CPD and deployment data can then be compared against the student outcomes (at a school and more granular level) to build a picture of the types of CPD that are effective in improving those student outcomes.

48. The school workforce census does not provide information on the movement of teachers or on how long they remain in teaching. These data, when related to information about teacher CPD (including mentoring and community engagement) would provide invaluable evidence on the ways to help retain teachers through support and CPD.

Are there any other standards that you have found particularly helpful? What is it about their format and content that we could learn from?

49. There exist standards for professional qualifications within the subject associations for the sciences. These are available for practising biologists, chemists, physicists, scientists and technicians. The highest professional standard is chartership. It is hoped that teachers will aspire to gaining chartership within their subject association through CBiol[15], CChem[16], CPhys[17], CSciTeach[18].

50. The standard should require that CPD leaders have sufficient subject knowledge and expertise to be eligible for chartered status in the subject(s) relevant to their CPD. We would expect CPD leaders to work towards that status where possible.

51. All of these professional standards are very clear on the requirements for ongoing CPD and reflective practice based on that CPD. In each case, credit is given to a broad range of CPD types.

52. The National Centre for Excellence in Teaching Mathematics have a standard for their CPD leaders[19].

How could the standard be introduced to schools and the wider system to maximise support and minimise workload? Please consider the process of introduction, the timescale, and the support given.

[14] Institute of Physics (2013). *The Stimulating Physics Network: A Report on Impact*: https://spt.app.box.com/SPNEvaluation/1/1344058938/12004734458/1

[15] Royal Society of Biology. *Chartered Biologist*: https://www.rsb.org.uk/careers-and-cpd/registers/chartered, https://www.rsb.org.uk/images/CBiolandCSciguidance.pdf

[16] Royal Society of Chemistry. *Chartered Chemist*: http://www.rsc.org/careers/cpd/practising-scientists/

[17] Institute of Physics. *Chartered* Physicist: http://www.iop.org/membership/char-sta/chartership/cphys/page_51812.html#1

[18] Royal Society of Biology. *Chartered Teacher:* https://www.rsb.org.uk/careers-and-cpd/registers/chartered, https://www.rsb.org.uk/images/RSB_Chartered_science_teacher_guidance.pdf

[19] NCTEM. *The NCTEM CPD Standard*: https://www.ncetm.org.uk/resources/21049

53. Introduction of the standard should be trialled. It might be piloted in a region to trial the data collection systems as well as the impact of the CPD.

54. The provision of CPD will grow and diversify in order to meet the demands for CPD. There needs to be an effective way for teachers and schools to evaluate their needs, find the CPD that they need and ensure that it is going to be high quality and have impact. A number of our organisations are working with the Wellcome Trust and the National Science Learning Network on improving understanding of the professional learning journey and we would welcome further discussion and engagement on this.

55. Providers will have to think about how the CPD they provide will be evidenced by teachers when designing their programmes.

Question 3
How could the standard help shape or improve the provision of professional development (including school-based professional development activities)?

Individual, in-school or third-party (other school, higher education institution, private or any other type of provider) CPD

56. At the very least, leaders of subject-specific CPD should be linked into their professional subject community. It should be an expectation that someone leading subject-specific CPD would have sufficient subject knowledge and expertise to be eligible for chartered status in the subject(s) relevant to their CPD.

57. There is an increasing diversity of CPD provision within each of the types outlined in paragraph 12. The type that is most open to a standard is direct face-to-face CPD – i.e. workshops and courses that are led by a coach or CPD provider. Such events are available from, amongst others, HEIs, schools, teachers, freelance individuals, companies, subject associations and local authorities. There is a wide range in the quality, expertise and experience of the individuals providing these services.

58. It should not be assumed that someone who has taught a subject for many years is going to be a high quality CPD leader.

59. Leaders of subject-specific CPD events should be expected to have demonstrated secure knowledge of the subject. They should also be able to demonstrate that they have a wide knowledge of the issues and research associated with teaching the subject. They should have a broad, embedded understanding of different approaches to teaching the subject and the issues and consequences with those approaches. I.e. they should be able to go beyond: “This is how I teach it”. They should be able to address ideas and naïve conceptions that some teachers may have with the subject knowledge and their PCK.

60. Furthermore, CPD leaders should have shown an ability to work with and coach adults in the subject.

61. CPD leaders need their own professional development in order to develop skills that enable them to be challenging and supportive of the teachers with whom they work.

62. CPD leaders (like teachers) benefit from being a part of a professional community of supporters. It is through communities that they can be linked to the best practice, research and their own professional development (as a CPD leader).

63. The professional bodies, in conjunction with a College of Teaching, have a role to play in this activity. The professional bodies are building such self-supporting communities. Being a part of such a community would contribute to the CPD leader’s own professional development which would be part of the requirement for chartership.

64. Subject associations can provide external expertise, give support and development opportunities, enable access to research and researchers and develop quality and capacity within the workforce of professional development leaders.

65. Any standard should require that teachers earn a certificate to show that they have both taken part in the CPD, reflected on it and gained something from it. In some cases, this may involve some form of assessment (possibly on-line).

Programmes, workshops, coaching or mentoring, enquiry or distance / on-line learning support

66. One of the most effective ways for teachers to find out about useful sources of help is through a self-supporting community. These exist as on-line forums and in e-mail lists for the sciences[20] and are also developed at teacher events and conferences. Face to face discussions sharing experiences and ideas can be highly productive.

[20] These include: talk biology, talk chemistry, talk physics, PTNC, Strontium, Synapse, Sputnik.

Question 4
What short-, medium- and long-term approaches might help to remove barriers to professional development and could be reflected in the standard?

Time and structures, including timetabling and impact on workload

67. Above all, it is about a culture change in the system where developing great teachers is seen as part of the role of the school (as employer) that benefits the teachers, the students, the education system and the nation. It may require some incentives to begin with; however, once the culture is established and is seen as a priority within normal practice, school leaders will find a way around any internal barriers.

68. The standard should emphasise that taking part in CPD is part of a teacher's core role, not an optional activity, nor an imposition that detracts from core teaching activities.

69. The barriers are fairly well-known (as highlighted in the question). There follow some of the barriers and suggestions for overcoming them.

a) Funding – the cost of cover:
   - CPD budgets should be ring-fenced and should include an element of subject-specific CPD.
   - Spending on subject-specific CPD should be reported, by subject, to the DfE in a school's annual report.

b) Funding the CPD:
   - Ring-fenced budgets can help;
   - There are models in which the provider is funded directly with a requirement on the number of people who attend their CPD (for example TSST[21]).
   - It is worth noting that there is a lot of high quality free CPD available. It is not the case that CPD that is free at the point of use is valued any less than paid-for CPD – it is the quality that matters.

c) Poor cover and/or having to catch up with teaching:
   - Make CPD accessible during non-contact time for teachers who choose to take part;
   - provide recognition for teachers taking part in CPD

d) The difficulty for teachers to get out of school:
   - Work with teachers in school – bringing in experts;
   - build a culture of recognising other forms of CPD (books, on-line resources, community forums etc.) which teachers tend to access away from schools
   - noting that the standard should encourage the use of a mix of CPD activities (it would not be ok if all CPD was online) – there are benefits to taking teachers out of their

[21] NCTL. *Teacher subject specialism training: secondary maths and physics*: https://www.gov.uk/guidance/teacher-subject-specialism-training-secondary-maths-and-physics

own school and mixing with other colleagues from different schools and the practical nature of the sciences means there is a need for opportunities to try things out.

e) Lack of non-contact time:

- 'Twilight sessions' in the schools work well.
- It is effective when CPD leaders visit a school for a day and work with individuals during non-contact time. And possibly with the whole department at the end of the day. However, it is important that teachers are recognised (in some way) for spending this time.
- On-line learning or community resources can help[22]. Having discussions with other teachers is effective CPD and this should be reflected with some recognition and encouragement.
- Many teachers access such community forums in their own time demonstrating that they are willing to take ownership and responsibility for their own professional development. Such professionalism should be recognised.
- There are also examples of alternative timetable models.

f) Lack of high quality subject-specific CPD leaders:

- Work with the networks of supporters established by the subject associations;
- build networks with other local teachers and find good sources of subject-specific CPD.

g) Hyper-accountability and a focus on exam result to the exclusion of all else:

- It should be part of the school's core role to provide its teachers with high quality CPD opportunities (including subject-specific CPD) and require and monitor their participation.
- The standard should specify a minimum number of hours per year to be dedicated to subject-specific professional development. This minimum amount should be commensurate with the requirements for chartered status in each subject area, reflecting a goal that all teachers should have a strong foundation of subject-specific knowledge in the subjects they teach.

70. The standard can help by:

a) In the short term – emphasising that meeting the standard is not dependent on attendance but rather on the impact on professional and student learning.

b) Schools should have a well-developed professional development policy that includes time allocated for subject-specific CPD. This policy should demonstrate how it supports the standard. It should be reviewed and approved by governors.

[22] Royal Society of Chemistry. *Learn* Chemistry: http://www.rsc.org/learn-chemistry; Supporting Physics Teaching: http://www.supportingphysicsteaching.net

c) Ofsted should evaluate the long-term planned support (including subject-specific PD) for all staff within the school.

d) Ensuring that CPD is fit for purpose and of high quality, helping teachers and school leaders recognise its value.

e) In the medium and long term – allocating professional time for CPD activities (including subject-specific CPD), some of which should be used at the teacher's discretion and giving teachers some ownership of their own development. Move away from the systems where all the CPD time is allocated to school priorities.

Question 5

Is there anything else you would like to contribute to help us shape the standard so that is useful in different types and phases of school?

Any other issues that you would like the standards to address, and any specific, innovative ideas you would like us to consider.

71. Whilst this consultation relates to a standard for teachers and CPD providers, it is worth noting that the teaching of the sciences in schools can be facilitated and improved by good technicians. Their development can run in conjunction or in parallel with teaching staff - particularly if the teachers' CPD relates to practical work. As employees in the schools, teachers should also have an entitlement to high quality CPD. Whether that forms a part of this standard or a separate standard for school staff as a whole, is a question for the Expert Group.

72. That sciences are practical subjects. The teachers of the sciences should be proficient and confident about using a wide range of apparatus. Therefore, one aspect of subject specific CPD in the sciences should be to develop teachers' competence with practical work and using apparatus. Clearly, as part of that development, teachers need opportunities to work directly with apparatus under guidance. However, there are also many excellent videos and resources (printed and on line) that can help, including: practicalphysics, practicalchemistry, practicalbiology[23], and the National STEM Centre. The standard can help by providing ways of expecting and recognising science teachers' own work to develop their competence and confidence in running demonstrations and leading practical work in their lessons.

73. There is evidence that major curriculum changes are most effective if teachers are supported in their implementation through CPD. The provision of this PD should form a part of the planning of any major curriculum change.

74. There exist examples of professional development of science teachers that involves the teacher in science research, including the Langton Star Centre[24], Authentic Biology[25]. Some of these experiences are being formalised and coordinated by the Institute for Research in Schools. Note that this is not educational research but real science research being carried out by teachers and students. Whilst it is early days, there are indications that this is enriching and motivational for teachers and may well help with retention for some.

75. Although the proposed standard would be non-statutory, it is important that the teachers are required to engage regularly in subject-specific professional development throughout their teaching careers. Monitoring the success of the non-statutory standard should be a priority, and the standard should be revised or reconsidered if it does not drive increased uptake of high-quality CPD.

76. In the absence of a statutory requirement that all schools meet the standard, government should consider other mechanisms to incentivise the uptake of the standards, such as:

[23] Nuffield Foundation. *Practical Biology*: http://www.nuffieldfoundation.org/practical-biology
[24] Langton Start Centre: http://www.thelangtonstarcentre.org/
[25] Authentic Biology: http://www.authentic-biology.org/

a) Requiring government to refer to the standard when funding PD programs or organisations;

b) Requiring schools to include their expenditure on standard-compliant professional development in their existing financial reporting;

c) Making the use of the standards a contractual requirement for new academies or free schools; and

d) Considering how Ofsted could incorporate measurement of professional development against the standard into their inspections.

77. College of Teaching: as a body run for and by teachers, it would be appropriate and desirable for the new College of Teaching to take ownership of the standard in the future. This would help promote acceptance of the standard and nurture a culture within the teaching profession in which CPD is a central part of being a teacher.

Appendix

Detail of CPD provision provided by organisations contributing to this response.

Association for Science Education

CPD project	Type of CPD events	Format
National Conference	Speakers from across the science education community, plus social events	4 days (international – 1 day)
Specialist Learning Conference	High profile science education speakers	2 days
Regional conferences	Mixture of teacher, commercial and researcher inputs	6 per annum
Regional and local meetings (single themes)	Single input with discussion	Several per region per year
Teach Meets	Mixed inputs and social event	Several per region per year
Online activities - ASEChat	Single theme each week	Weekly discussion
Journals School Science Review, Education in Science, Primary Science,	Sharing research, resources, updates and opinion	Published 3 times per year
Online activities – other social media	Communication and sharing	Online community
Committees and working parties	In depth focus on single issues	Ongoing
Registration Board	Professional recognition for members engaging in reflective developmental practice	Ongoing

Institute of Physics

CPD project	Type of CPD events	Number of teachers/teacher-days per year	Feedback ratings (likely to have impact on practice)	Long term impact measure
Teacher network	Expert-led enhancement workshops	1,200		
Stimulating Physics Network	Expert-led workshops and one to ones usually with non-specialists	3,100	94%	Uptake of A-level increased at twice national rate
SPN summer schools	Residential summers schools addressing physics	700		
Mentoring	Personal support for early career teachers	800		Early indications of improved retention
Teacher day meetings	One day network meetings for teachers	560		
Capital physics	Support for A-level physics teaching in London schools	400	96%	AS physics grades improved in 74% of partners schools
Improving Gender Balance	Pilot project to improve gender balance in schools	1,100	95%	Early days
PTNC	E-mail discussion list	> 500	(850 members about 15 posts per day)	Continued engagement and community
Talkphysics	On-line community forum with discussions	~ 420	(9000 members)	Continued engagement and community
Supporting physics teaching	On-line self-learning resource	~ 400	-	

Royal Society of Biology

CPD project	Number of teachers/teacher-days per year (past 12 months)	Feedback / Impact
Gopher Science Labs Training days Practical workshops for primary and secondary teachers Teacher led CPD training sessions for Gopher Science Labs Grants given to facilitate teachers sharing their experiences of Gopher Science Labs.	200+	In the process of receiving feedback from events this year.
	300+	Events still in progress
BioEd e-newsletter Sharing policy, events, resources etc.	Approximately 2500 subscribers	
Talk Biology Online forum open to educators and others interested in biology	260+	Increasing uptake.
Journal of Biological Education Publication which focuses on education research in the field of biology. (Available to all our affiliated schools)	300+ schools (plus individual teacher members)	Free content is available to download – however all affiliated schools receive copies.
Synapse Email network and google drive resources for Scotland	750+	Regular postings
Scottish Teacher Network Range of CPD events provided by education coordinators in Scotland	200	
Trainee Teacher Support Sessions Workshops demonstrating resources, hands on activities and promoting discussion hosted at universities.	250+	Positive feedback – however hard to track impact following trainee teachers.
Biology Education Research Group Group meets and discusses biology education research in schools and universities. Provides CPD at the ASE conference running talks on current education research.	50+ members of the group (teachers At ASE 120+ teachers	Development of reports and publications for the Journal of Biological Education.
Big Biology Giveaway Twilight talks, workshops and networking	40	

The RSB works closely with its member organisations. Many of these organisations work in specialist areas of biology and provide CPD activities for teachers e.g. the British Ecological Society and Field Studies Council provide support in fieldwork.

Royal Society of Chemistry

CPD project	Type of CPD events	Teachers/teacher-days per year (since start of 2015)	Long term impact measure
Chemistry for Non-specialists Face-to face CPD courses for those with a background in a different science (1 four day course)	Face-to-face CPD	262 teachers	In Greater London area over past 2 years shows teachers sampled increased test scores in: Pedagogical chemistry subject knowledge following CPD: (30% increase post-CPD) Teacher confidence (19% increase post-CPD) Summer 2014 participant feedback score summary: 99% responded very good/good - Overall quality of the course
Inspiring Creative Chemistry Teaching Face-to-face CPD aimed at trainees or those in the first years of teaching (3 one day courses)			
Developing Expertise in teaching chemistry Face-to-face CPD providing in depth understanding in 12 topics of with pre- and post-16 versions			
Developing Expertise in teaching chemistry Online CPD covers 14 online courses – 6 are launched and 8 are in development.	Online CPD	642 courses started	Most launched courses are new so in progress
Talk Chemistry	Online community forum	3300+ members	Continual posts
Learn Chemistry Partnership Free programme for	School network	3200+ schools/teachers	Increasing uptake
Learn Chemistry Award-winning home for chemistry resources, Includes nearly four thousand free resource downloads, articles, videos and data pages.	Online chemistry resources and tools	52,000 average unique UK users per month (peak month = 92,500)	Positive feedback, award-winning.
Education in Chemistry Magazine supporting chemistry teachers. Featuring demonstrations, CPD, articles, news and opinions.	Magazine (print, online, app)	3200+ (sent to all Partnership schools)	Engagement in online versions
Chemistry Education Research and Practice Journal for teachers, researchers and other practitioners in chemical education	Journal		

The Royal Society

CPD project	Type of CPD events	Number of teachers/teacher-days per year	Feedback ratings	Long term impact measure
Partnership Grants	Long term working with a practising STEM professional	60	Qualitative	Increase in knowledge, confidence and enthusiasm
Associate Schools and Colleges	Networking events with local scientists	140	-	Early days
	Blog and newsletter with community contributions	250	(125 in group)	Continued engagement and community
Teacher resources: Invigorate Inspiring Scientists	Online self-learning resource	11,153 UK users		