

Re: Draft National Curriculum for science

The ASDC response to the Department for Education's consultation

ASDC brings together over 60 of the UK's leading science engagement organisations, including major science and discovery centres, national museums, environment centres, university departments and learned societies. Together they engage 20 million people each year with the wonders of science, including over 7 million school-aged students and over half a million for curriculum linked workshops. Many of our member organisations will be responding to the consultation in their own capacities commenting in greater detail on the specific programmes of study they support. Here, and as an umbrella organisation, we comment on the overall approach.

ASDC welcomes the emphasis on giving science teachers greater freedom in how they teach, valuing and recognising their skills and expertise in getting the very best from their students. However we believe they need **greater support to make science lessons more engaging, more inspirational and more experimental**. We also feel strongly that all teachers and students, whatever their backgrounds, should have the ability to access to the latest exciting science techniques, activities and equipment which are commonplace in UK labs, but rarely glimpsed in UK schools, something that is easy to remedy.

Science is at its heart a hands-on, creative and investigative pursuit not a body of static knowledge, and should be vibrantly taught as such. If we want our young people to be creative scientist and engineers of the future we must give them the opportunities to learn in creative and innovative ways. This we believe should include an emphasis on out of school visits to inspire students, taking them to places where science is truly brought alive. This might for example be a visit to a science lab, a science festival, a University, or in our own case to a take part in a hands on experimental workshop at their regional science centre (within an hour drive of most UK schools).

Science and discovery centres across the UK are charitable enterprises that exist to engage people from all backgrounds with science. They run thousands of excellent curriculum linked workshops and laboratory sessions every year with millions of students. Their highly trained staff (most of whom are former teachers and scientists) support teachers and students with high end hands-on practicals, workshops and experimental activities with expensive equipment that individual teachers would find hard to do on an annual basis in their schools.

To give a flavour of what our centres can achieve, 20 UK centres from Dundee to Cornwall now run high level molecular biology workshops, many as part the ASDC Hands on DNA project. An excerpt from the independent evaluation of the first 1500 students at 15 UK centres is as follows:

Evaluation results from Students aged 14-16 after a workshop

95% felt it increased their confidence in them being able to understand this area of science

89% felt it increased their interest in science

90% of students had never used this type of equipment before in school

74% felt it made them think that working in science might be interesting

And their teachers said...

100% felt that more workshops like this would increase students' motivation to study science

85% felt that the workshop will have made them more likely to consider a career in science

100% of the teachers said that they would recommend the workshops to their colleagues

100% felt that the workshop inspired their students

A very large number of the science centres run physics based curriculum-supporting workshops for KS1-5, including high-end master classes and all manner of experimental workshops. An example of this is the 'Explore your Universe' project that ASDC runs in partnership with the research council STFC. Here 10 UK science centres have been equipped to run high-end experimental physics workshops and masterclasses. Science education academics will evaluate the first 4000 students in the programme and results will be available early in 2014.

We mention these, as to assume that science can only be taught inside a classroom is to give students a very small view of science, and to make them miss out on all the excellent opportunities which have been developed to help and support teachers across the UK. We also note that teachers and students embarking on new areas of study (such as computer sciences) can also be supported by innovative workshops and highly-trained staff at UK science centres.

There is now a growing body of evidence, especially from the United States and in the recent Wellcome Trust Review of Informal Science Learning, that schools science learning and informal learning are two sides of the same coin. Indeed most countries see this clearly (including Scotland, much of Europe). China for example is clear that it wants a talented and creative scientific workforce for the future and therefore invests in many out of school support systems for its students (and now has the world's largest science centre). They are doing this as they see a variety of science experiences as being vital to the wealth and prosperity of their nation in the future.



Largely, I will leave my colleagues in the variety of science and discovery centres and learned societies within the ASDC membership to comment on the individual content areas and programmes of study they support. We also add some of the more pertinent points from our members over the page.

However, on one single content area I feel the pressing need to comment, and that is of climate science. To leave this out of the curriculum implies that teachers can choose what they teach on the subject and how they do this. I do not feel this should be the case, given the overarching importance of understanding the data and evidence, given the variety of 'viewpoints' that arise based on no evidence, and based on and the effect that climate change will have on the lives on the pupils being taught.

With Kind regards

A handwritten signature in blue ink that reads 'P Fidler'. The signature is fluid and cursive, with the first name 'Penny' and the last name 'Fidler' clearly distinguishable.

Dr Penny Fidler | Chief Executive

Please see specific content points over the page...

Specific points from Science Centres on the science curricula

1. ASDC is please to respond to the Government's proposals for the reform of the National Curriculum in England. We endorse the view that we should set higher aspirations for all our school children and feel teachers should be supported more to achieve this.
2. Overall, the draft science curricula seem to display a missed opportunity. Rather than trying to get pupils to learn the basics and then get interested in the vibrant world of modern science, the content and approach appears rather outdated and reminiscent of schools 30 years ago. For example, there is no mention of the brain, climate science, material science, communication science etc.
3. Likewise, despite 30 years of research into education examining what works, the approach feels very much about what the teacher teaches rather than what the pupil learns. Anyone can stand at the front of a class and give information. It takes the talent of a great teacher and communicator to ensure all the students are enjoying, learning and understanding what is being imparted.
4. **Investigative and practical work:** Considerable evidence shows that practical work and the chance to explore and investigate is a key factor in science learning, giving them a sense of excitement and curiosity. We welcome the continued inclusion of 'Working Scientifically' in the curriculum, but would prefer that teachers are encouraged to present foundational knowledge in 'Working Scientifically', as opposed to simply teaching content and facts in the first instance.
5. **Support for teachers:** We ask for more support for non-specialist teachers in the proposed framework. Whilst this new approach will delightfully open up many avenues for skilled, specialist science teachers who can offer high-quality, engaging practical work, we feel it will create confusion for some less experienced or less talented teachers. The Select Committee report on practical science activities in schools (November 2012) highlighted many factors which may affect the quality of practical experiences available to school students, chiefly the need to support teachers, both during their initial training and also as continued professional development, to increase their skills and confidence in planning and delivering such activities. In the subjects of science we would be happy to discuss further how we could be of further support to teachers given that is what our charitable members do.
6. We are concerned that basic topics well within the grasp of KS1 students have been omitted, such as electricity, magnets, light, sound and forces (currently part of the Physical Processes section). This exclusion may have negative knock-on effects on the ability of teachers to cover 'Working Scientifically' in a broad and interesting fashion, not least through practical activities,



experiments and investigations. Pupils will be observing these phenomena in their own lives so should be making connections to the science.

Inclusion and Omission of topics:

- We welcome the inclusion of computer science within the new programme of study for science from KS1 onwards. Whilst it is not yet clear where funding and other support required for teachers and schools will be coming from, we offer our network to provide specialist support to teachers and students within this area.
- We are pleased to see that engineering is mentioned in KS1 science as part of looking at the 'humanly constructed world', but note that it isn't repeated in the introductions to KS2.
- Other notable omissions are space science at KS3, which many of our members know to be a very effective topic in sparking the interest of students.
- In biology, there are no mentions of the brain or nervous system – rather fundamental to us humans. This is reminiscent of the curriculum 25 years ago where the brain was seen as too little understood to teach in schools. Clearly this is not still the case and neuroscience is now one of the broadest areas of scientific study in most universities.
- Finally, evolution appears to be misrepresented as a series of separate investigations rather than an overarching theory that simplifies our view of the living world and brings coherence to the whole of biology.

Members of The Association for Science and Discovery Centres



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Appendix 1: Hands-on DNA: A National Science Project



'Hands-on DNA' is a national strategic project which aims to make highly engaging, practical molecular biology experiences accessible to students in all parts of the UK. These techniques are used routinely in the UK's hospitals, labs and universities, but rarely seen in UK schools. The project was created and run by The UK Association for Science and Discovery Centres (ASDC) with support from the Wellcome Trust.

The project team trained, equipped, mentored and supported staff in 15 science centres and museums in England, Northern Ireland, Scotland and Wales to successfully deliver high-end molecular biology workshops to schools in their part of the UK. The first 1514 students and 147 teachers participating at the 15 centres (in the first 4 months of the project) were part of the project's evaluation study. Students continue to participate in these workshops at all the centres.

Key results are below and full results can be found in the report on our website:

Evaluation results from students aged 14-16 after a workshop

- 95% felt it increased their confidence in them being able to understand this area of science
- 90% of students had never used this type of equipment before in school
- 89% felt it increased their interest in science
- 74% felt it made them think that working in science might be interesting

And their teachers said...

- 100% felt that the workshop inspired their students
- 100% of the teachers said that they would recommend the workshops to their colleagues
- 100% felt that more workshops like this would increase students' motivation to study science
- 85% felt that the workshop will have made them more likely to consider a career in science

Evaluation results from students aged 16-18 after a workshop

- 96% felt it increased their confidence in them being able to understand this area of science
- 93% felt in increased their interest in science
- 80% felt it made them think that working in science might be interesting
- 80% of students had never used this type of equipment before in school
- 80% felt the workshop would help them with their subsequent school work