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Campaign for Science and Engineering in the UK

Science and Society Consultation

General Comments

1. Campaign for Science & Engineering (CaSE) welcomes the Government's recognition that science improves peoples' quality of life, contributes to economic prosperity and is a component of good policy making. However for this to be achieved, the Government needs to fund a strong research base, educate scientists and engineers, attract corporate R&D, have an independent scientific advisory system, and adequate departmental and agency R&D budgets.

2. The consultation asks many open ended questions. It alludes to specific policy interventions, but does not set out what they might be. CaSE's response focuses on putting forward concrete proposals that that Government could implement. We have discussed some of the proposals with DIUS minister and officials already and would be happy to have further meetings to advance them. We will be looking to see Government commitments in the final strategy.

New vision for Science and Society

3. CaSE is an organisation that works with our members from the broad science and engineering community (business, universities, learned societies, professional institutes, research charities, publishers, and research parks) to advance policies to support science. CaSE supports the vision for a society that values science and engineering, is confident in its use and supports a scientific workforce. However, Government needs to focus on what it can do in this area as a main funder, educator, employer and user of science and engineering.

A society excited by and valuing science

Science outreach schemes

4. There are a diverse range of initiatives supported by government, industry, learned societies and charities to improve public (including schools) engagement in science. CaSE believes that there needs to be better sharing of information and evaluating programmes to see which work. For schemes funded by government this should be straight forward. Many schemes are funded outside of government and so the focus should be on facilitating best practice whilst supporting new innovative ideas.

5. CaSE understands that school outreach schemes will now be better databased. However, we are concerned that there is not enough evaluation of the various schemes. It is undoubtedly true that some of these are more effective than others and also possible that some are detrimental. As much feedback as possible should be gathered, analysed and fed back into the system on engagement activities. Assessing the impact in schools is incredibly important and here it would be possible to look at not only participant perceptions but also whether there was any evidence that it actually impacts on later behaviour – ultimately subject preference, and performance.

6. CaSE believes that the impact of many schemes could be increased by targeting them more effectively at groups most in need of engagement, for example, children on the verge of making decisions about which school to go to or subjects to take or under-represented groups. In a recent CaSE policy report, *Delivering Diversity: Making Science and Engineering Accessible to All*, we proposed that funding for school outreach programmes should be dependent on

those schemes being attended by students representative of that schools intake (before subject selection). For example, in mixed schools, science and engineering after-school clubs will only continue to receive funding if they are attended by equal numbers of girls and boys who are as ethnically diverse as the school's intake. Outreach programmes for older students should be targeted at under-represented groups.

Scientific literacy in schools

7. Scientific literacy could be supported by incentivising sciences and mathematics in schools. CaSE believes that higher UCAS points should be given to strategic subjects, such as science and mathematics. A recent CaSE briefing, *Higher UCAS Points for Science and Mathematics,* argued that a straightforward and effective way to get more students to take science and mathematics A levels would be to reward them with higher UCAS points for doing so. This is justifiable simply on the basis of strategic need but the suggestion is supported by evidence that these A levels are perceived to be harder than the average[1] which is currently working as a disincentive to students. Although this might not have much impact on students committed to a science career, as they would take these A levels anyway, it would encourage more uptake in students who are undecided or choosing a mix of A levels, some of whom would undoubtedly continue on in mathematics or the sciences, and the rest of whom would simply have had their science and mathematical skills raised.

Under-represented groups

8. The final strategy should also look at disabled scientists and engineers as an under-represented group. Disabled people are currently under-represented in SET occupations, making up just 3.8% of the workforce, as compared with 5.9% in other sectors. We lose out when disabled children struggle to envision a STEM career for themselves and when scientists and engineers develop a disability and change careers because they find themselves unsupported.

9. Considering how diversity can be encouraged more generally, CaSE believes that it needs to be implemented at the higher levels to pull others up. Belonging to a group that is under-represented is a disadvantage in itself, and this is partly because of the shortage of individuals at higher levels to act as role models, mentors, and reviewers or to provide support networks. Perhaps equally importantly, these groups may be poorly represented on influential committees, governing bodies, interview panels, etc.

10. Many under-represented groups would benefit from more flexible employment. Organizations should do all they can to support part-time work, accommodate career breaks, and improve work life balance for all. The proposed Research Excellence Framework must not penalise part-time workers or those returning to work after a career break.

11. CaSE applauds the Government's founding and ongoing commitment to the UKRC for Women in SET. It concretely shows the Government's genuine intent to achieve equality for women in this sector and illustrates to others its importance. The UK Resource Centre for Women in SET (UKRC) has been a valuable resource for women in science and engineering. CaSE believes that its work should be expanded or replicated so that other under-represented groups have a similar resource. Much more work is needed to understand the factors affecting the representation of different ethnic groups in STEM and to develop and identify successful initiatives to correct under-representation.

[1] Coe et al, (2008). *Relative Difficulty of Examinations in Different Subjects.* The Curriculum, Evaluation and Management (CEM) Centre, Durham University.

12. A national database should be developed for all under-represented groups in STEM to help provide role models, mentors, speakers, support networks, etc. The GetSET database managed by UKRC could be expanded or used as model for developing a new one.

13. The Government should fund a resource centre for disabled scientists and engineers. Currently information is available in a piecemeal manner. Much time and energy is wasted as educators and employers work with those with disabilities to find solutions that have been developed elsewhere.

14. The Government should also lift the caps on financial support for disabled undergraduate and graduate students to bring it into line with support for employment.

15. Schools in socially-disadvantaged areas are the least likely to have specialist science and mathematics teachers and most comprehensive schools do not teach separate physics, chemistry and biology GCSEs. The Government needs to:
    - Target specialist science teachers into the schools where they are most needed (could be determined by persistent vacancies). The "Golden Hello" should be better targeted and extended to primary schools. STEM graduates in PGCE primary courses dropped from 428 in 2004 to 227 in 2006.
    - Strengthen the triple science entitlement so that it is a statutory entitlement by 2010.
    - School outreach programmes should be attended by students representative of the schools intake. Outreach programmes for older students should be targeted at under-represented groups.

16. It is vital to ensure that teachers do not reinforce stereotypes about STEM workers that exclude certain groups. Careers advice should emphasize the potential of a science or engineering career for all, using a range of role models. Teachers should be trained not just to promote diversity but also in how to recognise and eliminate (hopefully unconscious) bias in their own practices. There is evidence that girls are treated differently from boys generally in school, and especially in science classes. Science teachers devote more time to boys, have higher expectations of them, and give boys more credit than girls for the same performance. Teacher perceptions are also affected by ethnicity. Black Caribbean students are not entered into higher tier science and mathematics papers at appropriate rates[i] and they are disproportionately encouraged onto vocational courses[ii]. It is important to make sure that topics included in the curriculum engage girls as much as boys and are across the areas of interest of different ethnic minority groups.

17. CaSE has developed a proposal a STEM Diversity Bursary: a scheme of university bursaries for STEM targeted to the brightest students studying these subjects in schools with a poor history of university access. These STEM Diversity Bursaries should work as an incentive to increase uptake of strategically important STEM subjects at school and beyond. They should also widen participation, particularly to include those from disadvantaged backgrounds and ethnic minorities. Participating in the scheme should draw both children and STEM teachers to schools that may not have previously been appealing, helping to even-out inequalities in the long-run. The scheme would be cost effective as money would not be spent on students likely to pursue STEM at university anyway. Many students are not aware of the bursary schemes available to them until too late. Locating this scheme within the schools should address this problem. Universities should recognise the potential that these students represent, even though their attainment may not be as high as traditional applicants. Several American states have schemes enabling the best students in public schools to go onto further study and students entering university through this plan complete their courses at normal rates and perform better than would be expected from their school grades. The Government should fund a STEM Diversity Bursary Scheme.

A society that feels confident in the use of science

18. Surveys have shown that the public is most confident with science that comes from university scientists. It is critical that the Government continues its sustained increased investment in the research base. Confidence in government science should be strengthened by building upon best practice in departmental scientific advice.

19. Scientists and engineers employed by the Government should have the right to speak about their research to the public and the media without constraint even if research findings may be seen to be at odds with official policy. The Government should develop its Universal Ethical Code for Scientists so that departmental and agency researchers have the freedom from political interference in their research, publishing, communications, and engagement with fellow scientists, policymakers and the public. This would be a step forward in building the confidence of the public in the work of government scientists.

20. Independent Chief Scientific Advisers and Scientific Advisory Councils have strengthened the Government's scientific advisory system. All remaining government departments that have not established an appropriate scientific advisory system need to do so as a matter of urgency. It is critical starting point for gaining the trust and engagement of the scientific community in a department's work.

21. It is unacceptable that the Department for Culture, Media and Sport declared its Head of Analysis its Departmental Chief Scientific Adviser (DCSA). Various reports (internal, parliamentary and government) called for the DCMS to appoint an independent DCSA. The Foreign and Commonwealth Office should also appoint an independent Chief Scientific Adviser. The Home Office should create a Scientific Advisory Council. The new Department for Energy and Climate Change should establish a strong scientific advisory system from the start. Government Office for Science needs to be strengthened so that departmental science review recommendations are seen through.

22. The Council for Science and Technology also needs to be strengthened so that it has a more powerful voice in providing cross-government advice on science and technology issues. It is currently not being used to its full potential.

23. Transparency of scientific advice could help gain the confidence of the science community and the general public. Departmental scientific advice should be made public record to demonstrate its robustness in the face of scientific scrutiny. Scientific Advisory Councils should meet in public, which is already being done by the Defra SAC.

A society that supports a representative well-qualified scientific workforce

24. CaSE strongly supports a well-qualified scientific workforce. We have discussed how the science education system and greater diversity can support a well-qualified scientific workforce in earlier sections. We believe that the civil service should do more to show that it values a well-qualified scientific workforce.

25. CaSE supports the Government's work to improve science and engineering profession in the civil service. We support the science and engineering fast steam as a way of getting more individuals with a technical background into the civil service. The problem is that there are very few opportunities. In 2007 there were only 15 positions in the science and engineering fast stream, which is roughly the same level as previous years. By comparison the economics fast stream appointed 101. Out of the 249 successful candidates for the general fast stream, which includes the science and engineering fast stream, only 37 had a STEM related degree. By contrast there were 82 people with a humanities degree.

26. Increasing the number of people within the civil service with engineering and technical skills needs to become a government priority. Policymaking requires a range of perspectives being brought to bear on an issue. A historical or economic perspective is important, but so to is a scientific or technical perspective. There needs to be a better balance of skills within the civil service. The Government needs to show its commitment to a well-qualified scientific workforce by expanding the science and engineering fast stream to be equivalent to the economic fast stream.

Measuring progress

27. CaSE disagrees that high-level targets are sufficient to measure collective effort. The Government should also focus on measuring progress on areas it can influence. Schools outreach activities are never a substitute for making sure that every child has the opportunity to study the science and mathematics that they choose, including triple science GCSE, and to be taught by teachers with specialist knowledge in those subjects. For academics to engage in policymaking there needs to be an 'intelligent customer' in the civil service to utilise it. We support the proposed vision and look forward to seeing in the final strategy proposals to make it a reality.

For more information on the issues raised in the consultation response, please contact:

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[i] Strand, Steve (2007) Minority Ethnic Pupils in the Longitudinal Study of Young People in England,
[ii] Count me in! Gender and minority ethnic attainment in school science, Frost, S., Reiss, M. & Frost, J., School Science Review, 2005, 86(316)