

## Department for Education: Reforming Key Stage 4 qualifications

### Response by the Wellcome Trust

December 2012

#### KEY POINTS

- We welcome the proposal to improve the quality and rigour of examinations at Key Stage 4. There is real potential to modernise the curricula with expert input and to ensure a continuous progression to A-levels and further qualifications. However, we are concerned that the current timescales for implementation are unrealistic and unworkable. If these changes are rushed, the success and reputation of English Baccalaureate Certificates could be damaged beyond recovery.
- All students should study a balance of biology, chemistry and physics at Key Stage 4. This requirement should be enshrined in a National Curriculum for Key Stage 4 or as a statutory requirement. A combined science EBC, equivalent to two qualifications (rather than a single science EBC) will be an essential way to deliver this.
- While we welcome the recognition of the need to challenge the most able students, we are not convinced that the needs of all students have been appropriately considered. Specifically, qualifications and certifications for students who would not achieve a GCSE grade C need to be thoughtfully developed as a priority.
- Science teachers must be able to participate in subject specific continuing professional development (CPD) in preparation for the new qualifications.

#### INTRODUCTION

1. The Wellcome Trust is committed to supporting science education. We work to ensure all young people develop the science skills and knowledge necessary to live and work in an ever more technological age. We believe it is important to equip young people with the understanding necessary to make informed decisions about the impacts of scientific and technological developments on their lives, as well as engaging and inspiring some of them to continue studying science. This includes developing the next generation of scientists, and helping others move into careers that draw upon science skills.
2. We are pleased to have the opportunity to respond to the consultation on reforms to Key Stage 4 Qualifications. We welcome changes to qualification content that will improve the quality of examinations and provide more challenge for the most able students.
3. We have responded to previous consultations on the reform to curriculum and assessment at various stages of schooling. There is an opportunity for coordination here that should be seized. However, the potential for improvements should not be risked by enforcing unrealistic timescales which limit the extent to which considered and expert input can be given. The rationale and approach to Key Stage 4 reform should inform those for the development of post-16 reform and vice versa<sup>1</sup>.

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<sup>1</sup> Wellcome Trust response to Ofqual consultation on A level Reform. (September 2011).

## SUBJECT SUITES: SCIENCES

4. **We believe it is essential that all students study a balance of biology, physics and chemistry up until the age of 16.** Each of these subjects contain core knowledge that everyone should be familiar with. We all need a basic understanding of the three sciences to make informed decisions and work in an increasingly scientific age. The sciences are becoming increasingly interdisciplinary, and the boundaries between them are rich areas for investigation and exploitation. Anyone wishing to progress in any of the sciences post-16 will struggle to do so effectively without having studied the breadth of them up until that point. For instance, it would be a challenge to study post-16 biology, if chemistry had not been studied until at least age 16.
5. If students are able to drop one of the sciences post-14, evidence suggests that serious inequities between the genders are likely to result. In 2007-08, Northern Ireland released its schools from following a National Curriculum post-14. Thus students in Northern Ireland can, for example, choose to take one, two or three of biology, physics and chemistry GCSEs. This has led to a change in the distribution of science studied: in 2007 entries for biology, physics and chemistry GCSEs were pretty evenly spread across the subjects and genders. In 2012, there were 4241 entries in biology, 52% of which were female, but only 3000 entries in chemistry, 47% of which were female, and 2884 entries in physics, 38% of which were female<sup>2</sup>.
6. The Department for Education and many other organisations, including the Institute of Physics and Royal Society of Chemistry, have fought over recent years to increase the popularity of the physical sciences in England. The battle has only recently begun to be won. If the requirement to study all three sciences up until 16 were dropped, it is likely that physics and chemistry would suffer and gender differences will emerge, as in Northern Ireland. If demand fails, and the number of graduates drops, we risk re-entering the downward spiral of a shortage of qualified physics, and to a lesser extent, chemistry teachers affecting teaching quality and reducing student progression.
7. We therefore stress the importance of ensuring that all students are required to study some biology, chemistry and physics at Key Stage 4. **We recommend that a National Curriculum should be specified for Key Stage 4 which should make this requirement clear. If there is no National Curriculum at Key Stage 4, there must be a statutory requirement** for all students to study a balance of biology, chemistry and physics.

### ***Is there also a need for a combined science option covering elements of all three sciences?***

8. All schools should be required to offer students the opportunity to study three separate science EBCs. However, we recognise that not all students will want to commit this amount of time to studying science. In order to ensure that these students are still able to study a balance of biology, physics and chemistry other options will be required. We consider there should be three ways for students to study all three of biology, chemistry and physics:
  - by studying three separate science EBCs (physics, chemistry and biology)

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<sup>2</sup> GCSE and Entry Level Certificate Results Summer 2012, Joint Council for Qualifications, August, 2012.  
<http://www.jcq.org.uk/examination-results/gcse/gcse>

- through a combined science EBC, equivalent to two qualifications (including some elements of physics, chemistry and biology)
  - an alternative combined science qualification – for example the current single science GCSE – that covers essential elements of the three sciences, for students for whom the higher load of two combined or three separate science EBCs would not be appropriate.
9. We agree with the consultation document that a single science EBC would not provide students with the scope and rigour to demonstrate real learning across the three science subjects, but recognise that the current combined science GCSEs are a popular option. **We are therefore proposing a combined science EBC equivalent to two qualifications** as an appropriate balance. This would draw from biology, physics and chemistry, and prioritise the content that all students will need to understand in order to make informed decisions and work in our scientific age. The combined science EBCs should not be an easier option, but would cover less content than the three separate science EBCs and, importantly, they should enable progression to science A levels.
10. Passing the required standard in the combined science EBCs should be enough to achieve an English Baccalaureate (EBacc). Provided that all three sciences have been studied in some form, we do not believe that success in three separate EBCs should be essential to achieve an EBacc. Where students do take three separate science EBCs, only two should need to be passed to the required standard for an EBacc.

***Should our expectation be that EBCs take the same amount of curriculum time as the current GCSEs? Or should schools be expected to place greater curriculum emphasis on teaching the core subjects?***

11. The Wellcome Trust is an advocate for biomedical science in context – nurturing its links to the other sciences and mathematics, and also its wider societal context. We work to enhance the teaching of science, but value study across many other subjects including art, music and design and technology. Space needs to remain for students to take these subjects. EBCs should take up the same amount of time that is currently given to core GCSE subjects; any greater time allocation would narrow the breadth of students' studies.

## **SYLLABUS**

***We intend that EBCs should be assessed 100% by externally marked examinations. Do you agree?***

12. The development of EBCs provides an excellent opportunity to improve the assessment of investigative and practical science skills and to ensure that the appropriate mathematical skills are assessed.
13. **We firmly believe that it is essential that all students are assessed for their practical science skills and that this assessment is achieved through direct observation of those skills.** We struggle to see how this can be achieved through externally marked examinations.
14. The potential for practical experiences to inspire and engage students is well recognised, but, more than that, practical skills are a core part of science knowledge – you simply have not learnt biology if you do not understand and cannot perform investigative work. Studying science without practical work is like studying music without learning how to

play an instrument – not very inspiring and useless for progression. Practical work requires expertise and resources and unless it is directly assessed it is unlikely to be sufficiently prioritised in school budgets.

15. The Gatsby Charitable Foundation and SCORE are developing recommendations on the best ways to assess practical and investigative skills and we urge the government to fully utilise their expertise in this area. It should be noted, though, that the proposed timetable does not allow enough time to properly agree which scientific skills should be assessed and how best to do so.
16. Biology, like all of the sciences, requires good mathematical understanding, from using probabilities in genetics, to interpreting experimental data. Mathematical skills should be taught and assessed across the curriculum. The low mathematical content of science specifications and examinations at GCSE and A level was highlighted by the report of the Science and Learning Expert Group<sup>3</sup>. Mathematical content should be strengthened within the science specifications and, most importantly, tested in the actual examination questions.
17. In specifying the broad expectations for subject content, we urge the Government to seize the opportunity to modernise the curriculum. The content of the biology EBC should reflect current biological understanding, not just for those progressing into contemporary science careers, but also to provide a bedrock of understanding upon which the general population can make informed decisions, particularly in relation to their health. Recent findings in biology affect core subject knowledge at Key Stage 4, for example, in appreciating the interaction between environment and gene expression in determining risk of medical disorders. The Wellcome Trust has supported NowGen to develop specific recommendations on the Key Stage 4 curriculum which can be downloaded from their website<sup>4</sup>.
18. It will be important to monitor how any increase in external assessment affects the performance of different groups of students, paying particular attention to gender.

## LOWER ATTAINERS AND EQUALITIES

### Qualification supports progression of lower achievers

19. The proposals state that EBC would be more rigorous than GCSEs. While we absolutely support setting high aspirations for students, it is vital that there is a realistic opportunity for all students to achieve valued qualifications.
20. The consultation document has too little detail about how those students who will not achieve the equivalent of GCSE grades C and above will have their skills valued. It states: *“Lower grades should give students an accurate assessment of their performance, and should have real value for their future progression to further education and/or employment.”* This is easier said than done, because the EBacc is essentially an academic qualification designed entirely to meet the needs of students who are university-bound.

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<sup>3</sup> Report of the Science and Learning Expert Group (2010). *Science and mathematics secondary education for the 21st century* <http://interactive.bis.gov.uk/scienceandsociety/site/learning/files/2010/02/Science-and-Learning-Expert-Group-Report-Annexes-31.pdf>

<sup>4</sup> Modern genetics education in school science: A manifesto for change. June 2012. <http://nowgen.org.uk/education/resource/nsgp-manifesto/>

## NO TIERING

### ***Do you agree that it will be possible to end tiering for the full range of subjects that we will be creating new qualifications for?***

21. We believe that it will be extremely difficult to assess the necessary range of student achievement without the use of tiered examinations. It is inefficient and ineffective to try to discriminate the full range of abilities of students with a single examination. Tiered examinations would enable EBCs to be adaptively delivered to a greater range of students.
22. **We are highly concerned by the lack of explanation of how students with practical and creative rather than academic strengths will have those recognised in a way that is valued by them, their parents and their future employers.** Failure to tackle this deficit will create a legacy of demotivation that is all too familiar from the days of O level.

## PROPOSAL FOR A SINGLE AWARDING BODY PER SUBJECT

### **High expectation of performance and accurate grading**

### ***Do you believe that we should insist on a common grading structure for all EBCs; or should we allow AOs the freedom to innovate?***

23. We welcome the intent behind the Department for Education's proposals to deal with the perverse outcomes of the current competition among awarding bodies. The move to a single specification offers the opportunity to tackle the poor quality of assessment that is evident in some awarding bodies' specifications. There is an opportunity to concentrate expertise in the setting, administering, marking and awarding processes to achieve a step change in the quality and professionalism with which assessment is carried out, the defects in which have recently been all too apparent.
24. It is vital that a full risk assessment is analysed before pursuing the proposal for a single awarding body per subject<sup>5</sup>. A major risk in the move to a single awarding organisation per subject is that creating a single, monolithic qualification, will have a chilling effect on innovation. We recommend that consideration is given to how to ensure that there is an inbuilt mechanism to encourage gradual innovation in specifications and assessment (rather than abrupt transitions). Equally, if subjects were to switch awarding body after five years this should not lead to overhaul for teachers and students twice a decade. Monolithic delivery also gives no redundancy in the system and no fall-back option if problems arise.
25. It is important that the public, employers and universities understand and have confidence in the process by which grades are arrived at. Yet little is known publicly about how awarding bodies proceed from marked scripts to final grades. The advent of EBCs is an opportunity to create a much more open and transparent process for awarding grades, to avoid, for example, the kind of fiasco that attended this summer's GCSE English award. It is vital to ensure that grading is comparable across EBCs in different subjects, but may be hard to do so if they are run by different awarding bodies.

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<sup>5</sup> See the analysis of this issue in Model 3 in the Wellcome Trust response to the House of Commons Education Select Committee inquiry: How should examinations for 15-19 year olds in England be run? (November 2011).

26. If the proposed model is pursued, we look forward to the opportunity to advise on the criteria by which the successful awarding body will be selected for inclusion in school performance tables. It should be noted that a “race to the top” could have detrimental consequences, as the perceived “race to the bottom” of awarding bodies is deemed to have done.

***In order to allow effective teaching and administration of examinations, what support do you think Awarding Organisations should be:***

- ***a) Required to offer?***
- ***b) Prevented from offering?***

27. Textbooks have increasingly become “examination guides” instead of providing broad and deep knowledge. Textbooks should be effective tools to aid deep and lasting learning. The endorsement of textbooks by awarding bodies exacerbates this problem by promoting teaching to the test. Of particular concern is that examiners are commissioned to write textbooks that are endorsed by an awarding body. This carries the risk that examinations could be used to maximise sales of books rather than in the public interest.

28. In Scotland, the SQA does not endorse specific textbooks, but supports a wide range of resources, including electronic resources, that can be used to teach the courses effectively. This is a sensible approach that does not unduly influence teachers or schools when purchasing appropriate materials (although it is important to ensure good access to electronic resources). We therefore urge the Government to take action to stop awarding bodies endorsing textbooks through Ofqual’s Codes of Practice.

## **IMPLEMENTATION**

***How best can we prepare schools for the transition to these reformed, more rigorous qualifications?***

29. While qualification content may drive what is taught it will not in itself change the quality of teaching. It is essential that teachers have the necessary subject knowledge for the new qualifications and the subject specific pedagogical skills to convey that knowledge to their students.

**30. All science teachers must receive subject specific continuing professional development (CPD) in preparation for the new qualifications.**

31. We appreciate the government’s ongoing support, matched by the Wellcome Trust, of £10 million for the delivery of science specific CPD at the National Science Learning Centre over five years from 2013. The National Centre is part of a Network of provision conceived by the Wellcome Trust and Government in partnership in 2003. We note that government support for the Regional Science Learning Centres is currently scheduled to decline from March 2013 and to finish in March 2015. We urge the government to revisit this decision; we have yet to ensure that every secondary school has teachers with the requisite specialist knowledge in biology, chemistry, physics and mathematics, and the new qualifications will increase CPD needs. In the current timetable there will be just 18 months for schools to prepare for the teaching of new qualifications in September 2015, in the last 6 months of which, the Regional Science Learning Centres would not receive government funding.

32. A cultural shift needs to occur before schools can be relied upon to directly fund science CPD to the necessary level out of their central budgets. We encourage the Government to do all it can to encourage this change in culture, for instance, through formally tracking teacher participation in CPD and requiring it to be considered in school assessment and as a requirement for career progression.

***Should we introduce reformed qualifications in all six English Baccalaureate subjects for first teaching in secondary schools in 2015, or should we have a phased approach, with English, mathematics and sciences introduced first?***

33. Key Stage 4 reform is happening at the same time as proposals for radical changes to A levels to bring them under the control of universities. We have welcomed this move and have called for the creation of National Subject Committees, led where possible by learned societies, to oversee the quality of these new A levels on behalf of the universities<sup>6</sup>. We believe that National Subject Committees should also play a role, in conjunction with Ofqual and the appointed awarding bodies, in securing the quality and standards of the new EBCs, so that they have continuity with the A levels that follow them.
34. Evidence-based policy making in education is essential and we urge the Department for Education to pilot the EBCs before rolling them out. This approach has proved useful in the past, for example, with the testing of the 21st Century Science Curriculum before it was rolled out. Given that GCSEs in many subjects would be running alongside EBCs (and that there are currently various IGCSEs, GCSEs and vocational options within individual subjects on offer), it should be relatively straightforward to pilot EBCs while maintaining the GCSEs on offer.
35. Even if EBCs are not pilot tested before national roll-out, we would strongly recommend that there is a phased roll-out or roll-out is delayed. The current timetable is not consistent with high quality. It will not be possible for the awarding bodies to develop rigorous and reliable examinations, with the input of external experts, in the period proposed.
36. If there is a phased roll-out, a formative evaluation process should be explicitly included, with lessons learned from the subjects initially rolled out, used to benefit later subjects (and update those initial subjects).
37. While we appreciate the urge to start roll-out with the core subjects of English, mathematics and science, it may make more sense to start with less central subjects so any lessons to be learned can then be applied to the core. In particular, the work needed to develop assessment of practical and investigative work means that science should not be introduced in 2015 and the need to align mathematics with the sciences means that this too should be delayed.

**THE PERVERSE CONSEQUENCES OF THE ASSESSMENT SYSTEM**

38. The danger with any examination system is that learning becomes directed towards achieving the best examination results rather than giving students a broad understanding of a subject - "the tail that wags the dog". Driven by the pressure to perform well in

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<sup>6</sup> Wellcome Trust response to Ofqual consultation on A level Reform. (September 2011).

examinations, teachers of science spend too much time preparing for examinations at the expense of doing stimulating practical work and teaching for understanding in depth.

39. English teachers operate in a high-stakes accountability system, for instance, poor results in performance tables can lead to falling applications and even school closure. Given the 'teaching to the test' that such a system promotes, the EBCs should aim to optimise such teaching by ensuring that the tests are high quality ones which really do assess learning in depth. This is true of practical assessments as well as 'theory' papers.
40. The Department's proposed consultation on accountability frameworks is an opportunity to look afresh at the whole system and seek to design school accountability systems that will bring about stimulating teaching and deep learning. We look forward to contributing vigorously to this discussion.

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