17 JANUARY 2014

NEW A LEVEL REGULATORY REQUIREMENTS

RESPONSE TO THE OFQUAL CONSULTATION

GATSBY

SUMMARY

1 The reform of science A levels is an opportunity to address their current failure to prepare students with the practical skills they need to study science at university. However the reforms proposed for science practical assessment do not have the support of scientists, are weakly evidenced, and are illogical. If practical skills are still to be assessed by teachers and moderated by Exam Boards to provide valid information for universities to use, these marks should contribute to the A level grade. Practical experimentation is the essence of science and must be a core part of A level assessment — otherwise the qualifications misrepresent the nature of the subject and can only be deemed tests of science theory.

2 In their report Maintaining Curiosity published in November 2013, Ofsted recommend that "The Department for Education (DfE) and The Office of Qualifications and Examinations Regulation (Ofqual) should ensure that qualifications include assessment of the skills needed for scientific enquiry" yet the current proposals from Ofqual reflect the exact opposite. Not only do they threaten to undermine the reputation of science A levels, they risk sending the message to schools and colleges that practical work is of subsidiary importance to textbook learning.

3 We propose that the regulatory requirements for new science A levels are amended to include an Assessment Objective worth at least 20% dedicated to the direct assessment of practical skills. Ofqual propose that non-exam assessment by teachers will form 20% of new A levels in English, History, Geography and Computing. We have not seen any evidence to show that there is any less integrity and professionalism among science teachers than teachers in these other subjects.

4 Neither have we seen sufficient evidence to discredit current, alternative models of directly assessing practical skills in physics, chemistry and biology, or evidence to suggest that models from other subjects and qualifications are unworkable in the sciences. We urge Ofqual to require Exam Boards to be more transparent with the data they already have on different methods of directly assessing practical skills and proceed with A level science reform on the basis of sound evidence which can be subject to wider scrutiny by independent experts.

INTRODUCTION

5 Gatsby is a foundation set up in 1967 by David Sainsbury (now Lord Sainsbury of Turville) to realise his charitable objectives. We focus our support on the following areas:

- Plant science research
- Neuroscience research
- Science and engineering education
- Economic development in Africa
- Public policy research and advice
- The Arts

6 Evidence shows that practical science needs support in UK schools and colleges[1] and Gatsby is currently engaged in a 5 year programme focused on better assessment, improved access to teaching resources, and strengthened roles for technicians and senior leaders as part of its wider work in science education[2].

7 Practical work is an essential part of science education. Good quality practical science develops important skills, deepens knowledge, enhances engagement among students, and challenges them to apply both knowledge and skills in purposeful contexts. In Ofsted's recent report on science education they found that the best schools "made sure that pupils mastered the investigative and practical skills that underpin the development of scientific knowledge and could discover for themselves the relevance and usefulness of those ideas"[3].

8 In January 2013 the Secretary of State for Education wrote to the Chief Executive of Ofqual to set a policy steer on the reform of GCE A levels. He wrote that "the primary purpose of A levels is to prepare students for degree-level study. All students should have access to qualifications that are highly respected and valued by leading universities"[4]. In recent research by Gatsby, 97% of lab managers in Russell Group universities surveyed reported that incoming undergraduates are poorly equipped for first year practicals. In the majority of cases (57%) this situation has reportedly worsened over the past 5 years, more so than declines in knowledge (29%) and understanding (37%)[5].

9 The reform of GCE A levels is therefore an opportunity to address current deficiencies and to improve the extent to which post-16 students are prepared to engage in practical science at university, while not threatening the recent increase teachers have secured in the uptake of physics, chemistry and biology A levels[6].

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[1] Resourcing practical science at secondary level (2013), SCORE.
[2] Further information about this programme of work and the evidence collected is on the Gatsby website (http://www.gatsby.org.uk/Education/Projects/Review-of-Practical-Science-in-Schools.aspx).
[3] Maintaining curiosity – a survey into science education in schools (2013) Ofsted.
[4] Letter from the Secretary of State to Ofqual Chief Executive, dated 22 January 2013 (accessed http://media.education.gov.uk/assets/files/pdf/l/ofqual%20letter%20alevels%20v2.pdf)
[5] Labskills of new undergraduates (Russell group survey), Laura Grant Associates for the Gatsby Charitable Foundation (May 2011).
[6] GCE Trends 2013, JCQ (http://www.jcq.org.uk/media-centre/news-releases/gce-trends-2013) .

KEY POINTS

10 This reform is an opportunity to address the present failure to ensure that those entering university science degrees have adequate practical skills. We therefore welcome the Chief Regulator's desire for "A levels to be the best possible preparation for students as they go on to the next stage in their lives". **But we are deeply concerned by the proposal that science A level grades should no longer include the direct assessment of practical skills, not least since this proposal has little or no support among scientists[7].**

11 On 9 January 2014 the Chief Regulator emphasised that "We are not saying practical skills are unimportant, we are saying they are so important that the assessment arrangements should not adversely influence (limit) what students experience and learn"[8]. Yet in 2012 Ofqual reported on a review of standards in A level Geography comparing qualifications in 2001 and 2010, when non-exam assessment was no longer permitted. Ofqual found that following the removal of coursework there were "fewer opportunities to assess the skills of students" and that "Coursework - typically a 4,000-word investigation - was an effective way to assess skills by, for example undertaking and reporting on investigative fieldwork. While Exam Boards now assess skills in a variety of ways within the four-unit, external examination structure, reviewers found that they were not as effective at assessing skills as coursework"[9]. **Ofqual's own research into the removal of coursework from Geography in 2010 indicates the importance of non-exam assessment of practical skills as part of A level.**

12 Practical skills – technical, investigative and analytical – in the sciences must continue to be assessed at A level, together with conceptual knowledge and understanding. We acknowledge the issues raised by Ofqual regarding assessment arrangements for Biology, Chemistry and Physics A level. But we note that if the proposed separate assessment is to "enable users of the qualification to identify students who might excel at practical skills but be weaker on other subjects" then it must be properly graded and reach the same standards of discrimination and validity as the written exam. **If the separate assessment as proposed can meet the high standards set by Ofqual then why can it not contribute to the overall A level grade?**

13 Ofqual must act on incidences of malpractice but we have seen no evidence that these incidences are greater in the sciences than any other subject which includes non-exam assessment at A level. Given that Ofqual proposes not only to retain this form of assessment in English, History and Computing, but to *introduce* it in Geography, **we see no reason for discounting non-exam assessment in the sciences when it will form 20% of the A level in other popular subjects.**

14 We do not accept that all forms of non-exam assessment in science A levels are equally flawed and we believe there are viable models, drawing on evidence from the UK and overseas[10], which deserve further discussion in terms of their success within current practice, the history of their use in previous qualifications and their potential for use under wider reforms to post-16 education. **Evidence for the relative success of the different forms of practical skills assessment currently in use should be made publically available by the Exam Boards for open evaluation.**

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[7] Teaching Science. Letter to the Times, 21 December 2013.
[8] Happy New Year – and an outlook for 2014. Blog of the Chief Regulator, posted 9 January 2014 (http://ofqual.gov.uk/blog/happy-new-year-and-some-thoughts-on-a-level-sciences/).
[9] Review of Standards in GCE A level Geography: 2001 and 2010 (2012), Ofqual.
[10] Reiss, M., Abrahams, I. and Sharpe, R. (2012) Improving the assessment of practical work in school science.

OPPORTUNITIES AFFORDED BY REFORM TO IMPROVE SCIENCE A LEVELS – OUR RECOMMENDATIONS

15 The proposed A level science content recently consulted on by the DfE makes very clear the need for students to carry out regular experimental and investigative activities, in the lab and in the field, in order to gain practical skills. These include: following written instructions; applying accuracy in practical work; making and recording observations; keeping appropriate records of experimental activities; use of safe practices; use of informational research skills; and using practical instruments, equipment and techniques appropriate to other domains of knowledge and understanding.

16 In the consultation on regulatory requirements for new A levels, Ofqual propose new Assessment Objectives for science A levels which require students to be assessed on their ability to:

- AO1 (30 - 35%) Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures.
- AO2 (40 - 45%) Apply knowledge and understanding of scientific ideas, processes, techniques and procedures:
  - in a range of theoretical and practical contexts;
  - when handling qualitative and quantitative data, to solve scientific problems.
- AO3 (25 - 30%) Analyse, interpret and evaluate a range of scientific information, ideas and evidence to:
  - make judgements and reach conclusions;
  - refine practical design and procedures.

17 We believe that the Assessment Objectives as proposed fail to make clear an expectation that science A levels should deliver the practical skills listed in the content proposed by the DfE - skills that we know from our research with lab managers from UK universities are important for students at the outset of their first year[11]. **We recommend that there should be a single Assessment Objective unambiguously associated with the direct assessment of practical skills and this should be weighted at a minimum of 20% of a science A level.**

18 There are many different forms of practical skills assessment in use across the current suite of science A levels: some practical assessment tasks are set by exam boards, others are set by centres themselves; with some A levels the assessments are supervised and marked by teachers, in others they are marked by the exam board. We note from reviewing recent A level science specifications that the nature of the task varies greatly as well – from site visits and case studies to individual investigations and competency tests. So too does the nature of the performance evidence collected, including written reports, teacher verifications of skills, written tests, task sheets, and oral presentations. Evidence from non-exam assessment used in the Extended Project Qualification (EPQ) and the Interdisciplinary Project of the Scottish Science Baccalaureate could prove equally fruitful, particularly in terms of moderation and verification.

19 **We therefore expect the Exam Boards are in an excellent position to provide better evidence than they have to date made public, in order to inform decision-making on the way forward.** Due to the competitive environment of the qualifications market, Exam Boards have been cautious about the evidence and ideas they share publically, and this has

[11] Practical skills of new undergraduates (Workshops), Laura Grant Associates for the Gatsby Charitable Foundation (Oct 2011). Forty-five HE staff from bioscience, chemistry and physics departments in twenty-five UK universities participated.

constrained open discussion about ways forward. This situation has to change for stakeholders to be truly engaged and consulted.

20 In addition, further opportunities for developing better assessment are afforded by:

- Learning from **successful and accepted practice in other subjects, other countries and other qualifications**. The research we commissioned from the Institute of Education, University of London, and the University of York (cited earlier) highlighted practice in China and Finland, as well as in music and modern foreign languages, which represented a rich vein of evidence from which those engaged in developing assessment of practical skills in science could draw.
- An evaluation of **changes Exam Boards have already put in place to improve practical skills assessments.** For example, AQA has introduced staggered release dates and shorter windows for their Investigative Skills Assignments (ISAs) and Externally Marked Practical Assignments (EMPAs) in 2014, as well as a new rule that all students at a school or college must sit the EMPA written test on the same day. OCR will be applying a 'slightly tighter tolerance' in the moderation of the coursework/practical skills units at A level and will be delaying the publication of marks schemes for practical tasks. We envisage Ofqual will be requiring the Exam Boards to report back on the impact of these changes later this year.
- The **removal of the January exam opportunity** from the A level timetable giving teachers additional teaching time during the second year of A level[12] which could be used to more easily incorporate a task such as an individual project into the assessment regime.
- An exploration of the **diverse methods of assessment of skills used in Higher Education** and how students could be better prepared for them. Researchers at Cambridge Assessment have found "a greater variety of assessment types at university in comparison with A level", particularly in Biology (when compared to English and Mathematics) which included "many different forms of practical assessment, coursework and presentations"[13].
- An exploration of how **cluster moderation** involving local teachers can increase the validity of teachers' summative assessments. Researchers at King's College London report that English and Maths teachers in a sample of secondary schools positively addressed validity issues in their assessment practices through the use and discussion of **portfolios** and participation in moderation exercises both within and between schools[14,15].
- **Lab books** have been suggested as a potentially significant part of portfolios for students taking science A levels, forming evidence which could be used as a check that a range of practicals have been undertaken, and could formalise behaviours such as learning from mistakes, keeping appropriate records, managing time effectively in the lab and working both independently and collaboratively in the lab or field.

[12] Impact assessment of A-level reforms: A study commissioned by Ofqual from ICF GHK consulting and published in November 2012.
[13] A comparison of assessment at university and A level: research from Frances Wilson, Simon Child and Irenka Suto as reported in Spotlight Science, OCR 2014.
[14] Black, P, Harrison, C., Hodgen, J., Marshall, B. and Serrett, N. (2011) Can teachers'summative assessments produce dependable results and also enhance classroom learning? Assessment in Education: Principles, Policy & Practice, 18:4, 451 – 469.
[15] Black, P, Harrison, C., Hodgen, J., Marshall, B. and Serrett, N. (2010) Validity in teachers' summative assessments, ? Assessment in Education: Principles, Policy & Practice, 17:2, 215-232.

RESPONDING TO THE ISSUES RAISED BY OFQUAL IN THE ASSESSMENT OF SCIENCE A LEVELS

APPROPRIATE BALANCE OF EXAM AND NON-EXAM ASSESSMENT

21 In order to create a better balance between exam and non-exam assessment in A levels Ofqual have "taken into account the balance struck at GCSE and the skills higher education institutions consider should have been assessed in students arriving for undergraduate study in these subjects". We believe the most appropriate balance for science A levels is to retain at least 20% assessment of practical skills, particularly given the evidence that A levels are not adequately preparing young people for the practical demands of undergraduate science courses at university.

22 In the GCSE science criteria proposed by DfE in June 2012, practical skills form a minimum of 20% weighting, with 10% directly assessing technical and investigative skills. We ask if it can be done for GCSE, why not for A level?

PREDICTABILITY OF ASSESSMENTS

23 Ofqual propose that the separate reporting of performance in practical assessments in biology, chemistry and physics will 'facilitate less predictable practical assessments and address concerns about the conduct of the assessments and their failure to discriminate between students'. Predictability comes from familiarity, and we find no reason to expect that exam-based assessment is any less predictable than non-exam assessment when it comes to the cumulative experience of teachers after a few years of exam preparation. In fact we have heard from some experienced examiners that independent investigations decrease the level of predictability in practical assessment.

ABILITY TO DISCRIMINATE BETWEEN STUDENTS

24 We were surprised to read in the consultation document that the data collected by Ofqual from exam boards showed that "current practical skills assessments do not discriminate well between students" and that in the non-examined units "students' performance in practical assessments greatly exceeds their performance in written exams". In an effort to understand whether these conclusions applied equally to all the different forms of assessment in use, we requested the evidence behind this assertion from Ofqual. On 15 January we were grateful to receive a partial delivery of the data requested but were not able to analyse it in sufficient detail to form a significant part of our response to the consultation. However, a preliminary analysis of a related set of data released by Ofqual on 8 January 2014 suggests that there *is* reasonable discrimination within some of the non-exam units in current use, and while some may be skewed to the top end of the marks they still discriminate across the entire grade range. We will be looking at this data, and any that follow, in further detail over the next few weeks.

MALPRACTICE

25 Claims of malpractice in the administration of science A levels must of course be dealt with by the Exam Boards responsible, and there will be times when the regulator must intervene. However the response must be proportionate to the level of confirmed cases, and following on from the concerns reported in their consultation document, Ofqual have since clarified to us that of the 53 cases of malpractice investigated by the Exam Board concerned in relation to science A levels, 13 were "minor examples of general candidate malpractice" and only 18 of the remaining 40 alleged claims were upheld.

26 Malpractice is a serious issue, but if it is to be used to suggest that science teachers cannot be trusted to undertake any internal assessment then we need to have better evidence that it is widespread, persistent and impossible for the Exam Boards to rectify through existing monitoring and moderation processes apparently successful in other qualifications they administer.

WHAT TO ASSESS

27 Ofqual proposes that only the "development of conceptual and theoretical understanding of experimental methods" will contribute to the A level grade. We agree that this understanding should be assessed but theoretical understanding of an experimental method without the ability to put that method into practice is of little value in preparing students for studying science at university.

MOVING FORWARD

28 We strongly recommend that Ofqual do not proceed with their current proposals for the assessment of science A levels but instead:

- properly reflect the importance of practical skills in science A level by redrafting their proposals to include a single Assessment Objective dedicated to the direct assessment of practical skills with a minimum weighting of 20%;
- require the Exam Boards to thoroughly evaluate the assessment models already in use and make this data available for review and evaluation by independent experts who can advise Ofqual on the most appropriate assessment method for each of physics, chemistry and biology A level in the future.

29 Questions regarding this response should be directed to:

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