

Pearson response to Ofqual Consultation on the Assessment of Practical Work in GCSE Science

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Organisation details

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Information about our response

Would you like us to treat your response as confidential?*

If you answer yes, we will not include your details in any list of people or organisations that responded to the consultation.

() Yes (X) No

Is this a personal response or an official response on behalf of your organisation?*

() Personal response (Please answer the question 'If you ticked 'personal views'...')

(X) Official response (Please answer the question 'Type of responding organisation')

If you ticked 'Personal views' which of the following are you?

- Student
- Parent or carer
- Teacher (but responding in a personal capacity)
- Other, including general public (Please state below)

If you ticked "Official response from an organisation/group", please respond accordingly:

Type of responding organisation*

- Awarding organisation
- Local authority
- School or college (please answer the question below)
- Academy chain
- Private training provider
- University or other higher education institution
- Employer
- Other representative or interest group (please answer the question below)

School or college type

- Comprehensive or non-selective academy
- State selective or selective academy
- Independent
- Special school
- Further education college
- Sixth form college
- Other (please state below)

Type of representative group or interest group

- Group of awarding organisations
- Union
- Employer or business representative group
- Subject association or learned society
- Equality organisation or group
- School, college or teacher representative group
- Other (please state below)

Nation*

- England
 Wales
 Northern Ireland
 Scotland
 Other EU country
 Non-EU country

How did you find out about this consultation?

- Our newsletter or another one of our communications
 Our website
 Internet search
 Other

Communication directly with Ofqual

May we contact you for further information?

- Yes No

Questions

Question 1: In relation to our proposed model (page 5 and pages 23 to 29 of the consultation) how far do you agree with each of the following statements?

Please give reasons for your answers.

1a: GCSE science students will be given appropriate opportunities to complete a range of practical work if exam questions reward those who can draw on their practical experiences.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

In our research with teachers, we have found that the use of controlled assessment is at risk of narrowing the range of practical work carried out in schools to the practicals that form the basis of the controlled assessment. With 25% weighting assigned to the controlled assessment unit, there is pressure on teachers to focus on ensuring students succeed in that one particular practical.

In contrast, our research with our International GCSE and Level 1/2 Certificate centres has found a vastly different story. They report that the removal of coursework and the addition of questions in the examinations frees them up to carry out a wide range of practicals that enhance teaching and learning. We think that taking a similar approach for GCSE would be a positive step.

Key to the success of this approach is ensuring that questions in the assessments critically differentiate in such a way as to advantage those candidates who have had a rich experience of practical work.

1b: At least 15 per cent of the marks in science GCSE exams should be allocated to questions drawing on students' practical science experiences.

- Strongly agree
 Agree
 Neither agree nor disagree
 Disagree
 Strongly disagree

This is commensurate with the approach taken at A level. Practical marks should be numerous enough to make schools take practical in science lessons seriously, but not so many as to over-assess practical.

1c: Science GCSE students will be more likely to be given opportunities to undertake a wide and varied range of practical work if such work is focused on teaching and learning and is not itself assessed.

- Strongly agree
 Agree
 Neither agree nor disagree
 Disagree
 Strongly disagree

Schools offering IGCSE or L1/L2 Certificate in sciences have told us that the lack of assessment being directly pinned to practical work has freed them up to select practicals that are best for teaching and learning. Therefore we do not see any advantage in directly assessing students on their practical skills. However, resourcing issues in schools, for example lab provision or consumables budget, mean there can be a risk to the provision of practical work should it not be linked in some way to an assessment.

Therefore, while not advocating assessment that slavishly ensures practicals are carried out by pinning part of the grade to it in a discrete package which is separate to the external assessments, we would advocate that there is an indirect incentive to carry out practical work in the form of integrating into the external assessment. Good teaching and learning of science integrates practical and theory together: our proposed style of assessment mirrors this.

1d: Science GCSE students will be more likely to be given opportunities to complete the practical work included in an exam specification if schools are required to confirm this in writing to their exam board.

- Strongly agree
 Agree
 Neither agree nor disagree
 Disagree
 Strongly disagree

We do not believe that the requirement for confirmation in writing will encourage centres to do practical work. Proposals to include practical skills in examinations should ensure that the practicals are fulfilled.

We require centre confirmation of coverage of core practicals in some of our qualifications, for example A level Biology (2008). Teachers have reported that this is an unnecessary administrative burden when, as a matter of course, they will aim to achieve the coverage required by the specification in the time available in order to prepare students adequately for external assessment. In contrast we do not require written confirmation from centres that they have carried out core practicals for GCSE, but our research with teachers indicates they do cover them. In addition, a process whereby a letter is used to prove that work has been done is difficult to police.

The proposed core practicals will hold the same status as the theory statements within the specification. We do not require teachers at present to confirm in writing that they have covered, for example, theory of the periodic table in their teaching, so there is no reason to require confirmation of coverage of practicals.

In addition, there is a point about the status of practical work. In making the distinction between theory and practical in this way and separating them out artificially we would send the message that theory and practical are elements that can be divorced. Our message should be that practical and theory should be so integrated as part of good teaching and learning that it should be impossible to separate them out.

There is also a role of Ofsted in ensuring a balance of practical and theory in the teaching and learning of science, and this is a much greater incentive to embed practicals in science than the requirement for written confirmation.

1e: Science GCSE students will be more likely to be given opportunities to undertake a wide and varied range of practical work if they are required to keep a record of such work (a student record).

- Strongly agree
 Agree
 Neither agree nor disagree
 Disagree
 Strongly disagree

Please give reasons for your answer

Teachers may be concerned that it is more important that the student records the 'correct' conclusion of the practical for the purpose of the record, especially if it will be externally checked, rather than allow students to use the process to reflect on what they have observed and how that relates to the scientific theory. We recommend that students should be required to keep a record of their work in practicals; writing up practicals and reflecting on what they have observed is all part of good teaching and learning. However, we do not believe this should be official documentation as that would lead to the danger of these write-ups becoming stifled. This approach would do little to ameliorate the existing issues faced in current qualifications with CATs (and legacy qualifications which had coursework elements). In addition, any external moderation of these practical write ups would be unmanageable for awarding organisations at the scale required.

1f: It would be unmanageable, in terms of time and cost, for teachers to assess directly each of their science GCSE students manipulating a range of equipment and conducting a range of experiments to confirm their competency in practical skills.

- Strongly agree
 Agree
 Neither agree nor disagree
 Disagree
 Strongly disagree

It would be highly unmanageable for many centres to assess each student directly. Our biggest centres have in the region of 300 students per year group. Keeping a record of practical competency for every student would be a great administrative burden.

The other question to be asked is, as well as being unmanageable, would a measure of practical competency be useful for employers and practitioners in further education? The A level practical endorsement is useful to HE or the workplace as it is a signal to them that the students are practically competent when entering institutions where an existing degree of competency in the laboratory will be required. For GCSE, students progressing on to further education after GCSE will develop competency through a wider range of practicals in their L3 courses; in A level with the new endorsement model or in vocational courses where their laboratory experience will be much more rich than at GCSE. Therefore it is not necessary for them to enter further study with a defined level of competency. In addition, few students go directly from GCSE to working in a lab, so we would argue that an endorsement would not be necessary.

1g: The revised assessment objectives for science GCSEs are appropriate.

- Strongly agree
 Agree
 Neither agree nor disagree
 Disagree
 Strongly disagree

With some reservations about specific wording, we believe the overall aims of the assessment objectives are appropriate. Students should be required to show knowledge and understanding of both theoretical and practical science, be able to apply that knowledge and understanding in novel contexts and also be able to critically analyse information in order to make judgements and form conclusions.

1h: The weightings proposed for the revised assessment objectives for science GCSEs are appropriate.

- Strongly agree
 Agree
 Neither agree nor disagree
 Disagree
 Strongly disagree

The body of knowledge prescribed in the DfE subject criteria is extensive. In order to ensure full coverage of this knowledge over the course of the lifetime of the qualification, we would recommend that the AO1 35% weighting is reviewed and possibly upped to 40%.

Equally, the AO3 element accounts for a high proportion of marks at present. This is incongruous, as AO3 is acknowledged as the most demanding AO; in the AS level from 2015 it will be apportioned 20-25% and in the full A level 25-30%. Therefore, we would recommend that this is lowered slightly to 20% in the GCSE.

1i: The weightings proposed for the assessment objectives for science**GCSEs should be the same at each tier.**

- Strongly agree
 Agree
 Neither agree nor disagree
 Disagree
 Strongly disagree

All of the skills required by the assessment objectives should be tested, at varying levels of demand, in the assessments. AO3 is inherently a challenging objective, but it can still be tested at Foundation tier using an appropriate level of demand, for example by using a slightly less complex scenario than would be found in the Higher tier.

There would be potential for perverse decisions to be taken around tiering if the AOs were not comparable between F and H tier. For example, if Foundation tier had a lower proportion of AO3 than Higher tier, it may lead to capping of student aspirations by schools automatically putting them in for the Foundation tier (and restricting them to a 5 at the most) so as to reduce the number of questions testing the more demanding AO.

1j: The proposal that no less than 15 per cent of the total marks available in a science GCSE must be used to credit the demonstration of mathematical skills is appropriate.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

We would agree that a 15% requirement of mathematical skills would be appropriate, on the assumption that all calculation questions would be included in this percentage. This would be our preferred option. The proportions we currently have in our assessments include maths at all levels, and are wider than the skills listed in the DfE criteria; our assessments include approximately 10% calculation questions in biology, 10-15% in chemistry and 15-20% in physics. However clarification is needed on whether the 15% requirement would only include the maths skills covered in the DfE subject criteria and whether or not the requirements at each tier for the science subjects must be commensurate with the requirements at that tier for the new maths GCSEs. In this case, we would need to review the allocation of mathematical skills in our assessments as a 15% allocation to mathematical skills could lead to a disproportionately high percentage of maths assessment in the science qualifications.

1k: The proposal that no less than 15 per cent of the total marks available in a science GCSE must be used to credit the demonstration of mathematical skills should apply to each of the science GCSE subjects.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Due to the nature of the sciences, some subjects lend themselves better to the inclusion of a higher percentage of mathematical skills than others. Much of the GCSE Physics content (and to a lesser extent, GCSE Chemistry) content relates to calculation questions, whereas the GCSE Biology does not have as wide a range of opportunities for use of mathematical skills. In addition, our papers currently differ in their allocation of calculation questions, with GCSE Biology having a lower percentage compared to GCSE Chemistry, and this being lower than GCSE Physics. We would propose the percentage requirement of mathematical skills should not apply to each of the science GCSE subjects, but rather as an average across the four qualifications. This would mean that we could consider a model where we allocate mathematical skills (clarification is required on the allocation of mathematical skills) as 10% in biology, 15% in chemistry and 25% in physics; the double award would then mirror this structure. In this way we would be able to work with the subjects and assess mathematical skills in a more holistic way. (NB the proposed proportions are dependent upon clarification on the allocation of mathematical skills as indicated in 1j).

11: The lists of apparatus and techniques that all students taking science GCSEs will be expected to be able to use are appropriate.

- Strongly agree
 Agree
 Neither agree nor disagree
 Disagree
 Strongly disagree

The majority of the techniques are appropriate, and in fact the vast majority are techniques we currently ask students to carry out as part of the core practicals. The proviso is that it is not the techniques, but the core practicals that derive from them that will be required to be in the assessments. For example there are practical techniques in the list that cannot be tested in a written exam, such as making a drawing of a slide observed through a microscope. However, we could test understanding of how to focus a microscope in an external assessment or indeed ask for interpretation of a given slide image.

In addition, it is worth noting that some of the techniques requiring digital meters may currently not be resourced for in some schools, and will require considerable financial outlay.

1m: The proposal that exam boards must require each student taking science GCSEs to undertake at least eight practical activities (16 for combined science) is appropriate.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

In order to promote a rich experience of practical work, we believe that there should be an increased minimum number of core practicals. Currently, our GCSE specifications have core practicals to enhance the teaching and learning of the theory. We have around 18 specified for each specification. For the equivalent of Combined Science (Science plus Additional Science) this would equate to 36 practicals. While this number has been reported by teachers as being on the high side (but ultimately manageable), the minimum proposed is less than half this number.

Assuming we adhered to the minimum requirement, over the two year course of study, a candidate in Combined Science would experience practical work, therefore, on average just over once every half term (16 core practicals, 12 half terms). This is not conducive to integrating practical into the teaching and learning, and will not serve to promote the teaching of practical in schools. To make it more meaningful then we would suggest the minimum number for each GCSE to be 12 (24 for combined science) and that rather than a minimum number it would be fixed so as to ensure that the GLH would be similar for all AOs.

It could be argued that adding in more practicals as 'suggested' practicals could be used to supplement the eight core practicals. However, in not being part of the subject content, knowledge and understanding of them could not be assessed in the exam, which in turn would not promote their teaching in the classroom. For this reason, we do not believe a halfway-house approach of adding suggested practicals is appropriate.

Question 2

Do you have any views about what form the student record should take and the types of information it should contain? If 'yes', please give suggestions below.

Yes

No

As detailed in Question 1d and 1e, we do not believe that a student record is required. There are two purposes a student record could fill. Firstly, it could be a record that students have completed the practical. Secondly, it could be a formative tool used for students to record and process results and draw conclusions about the practical work they have carried out.

We believe that it should be the latter and it should be non-formal documentation with freedom for schools to allow students to record their practical experiences in way that helps them learn. A student record of practical work is an excellent way for students to engage in the science and is all part of good teaching and learning. This record could also be used for revision purposes.

Using a student record to prove the former will constrain the evidence that teachers and students feel compelled to record.

Question 3

We are looking for the approach to the assessment of students' practical science experience that can achieve the best balance between the aims of:

- **delivering the curriculum aims and encourage a wide range of practical science teaching over the period of study**
- **being manageable for schools – taking into account the numbers of students who take science GCSEs, the range of ability and the time typically allocated to each subject**
- **providing valid and reliable assessments – test the right things and do this accurately and consistently, so as to differentiate effectively between students' performance**
- **being able to withstand accountability pressures, that is, to avoid exerting unmanageable contradictions on teachers where they are acting as the assessor and being judged themselves through the outcomes of the assessments they make – the results of their students.**

How far do you agree that our proposed model (page 5 and pages 23 to 29 of the consultation) provides the best balance between these aims? Please give reasons for your answers.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

We wholeheartedly agree with some elements of the proposals, but we also disagree with some elements.

Delivering the curriculum aims and encourage a wide range of practical science teaching over the period of study

Embedding core practicals within the specifications and testing them in the exams is an excellent way of encouraging a wide range of practical science teaching.

Critically, it should not just be knowledge and understanding of specific practicals that are tested but also an inherent understanding of the scientific method itself, which can only be developed over a period of time over many practical experiences. We do not believe that it is a necessary addition to include a student record and subsequent confirmation to the awarding body. The most powerful way of ensuring that practical work is carried out is to test it in the examinations and write the questions in such a way that students who have carried out the practical work would be at a significant advantage.

In general the practical techniques are appropriate, with the proviso that is not the techniques, but the core practicals that derive from them that will required to be in the assessments. For example there are practical techniques in the list that cannot be tested in a written exam, such as making a drawing of a slide observed through a microscope. However, we could test understanding of how to focus a microscope in an external assessment or indeed ask for interpretation of a given slide image. In addition, it is worth noting that some of the techniques requiring digital meters may currently not be resourced for in some schools, and will require considerable financial outlay.

Being manageable for schools – taking into account the numbers of students who take science GCSEs, the range of ability and the time typically allocated to each subject

The number of core practicals is very definitely manageable. In fact, Edexcel GCSE centres currently deal with twice the number proposed, so we would argue for an increased minimum so as to embed practical science into the science curriculum. Assuming most schools would retain the status quo as regards to the time allocated to science, the excessive amounts of time taken up by controlled assessment currently could be devoted over to a broader practical experience.

The proposals for the student record and the requirement for proof to the awarding bodies that practicals have been carried out pose a potential manageability issue, especially for larger centres. Without students being tested on their competency (which for reasons detailed above we believe is not necessary) we would argue there is no requirement for such extensive record keeping. There are three drivers in play to ensure these practicals are carried out without the need for such an administrative burden:

The role of the awarding bodies in ensuring questions set in practical contexts advantage those students who have been exposed to practical work.

The role of Ofsted in ensuring a fair and balanced science curriculum, including an appropriate amount of practical work.

The role of the professionalism of teachers to want to deliver a broad and balanced curriculum free from the constraints of controlled assessments.

Providing valid and reliable assessments – test the right things and do this accurately and consistently, so as to differentiate effectively between students’ performance

In general, the Assessment Objectives (with small alterations) will allow us to test aspects of practical work so that students who have engaged in a wide variety of practical activities will be at an advantage. We will be able to test both knowledge and understanding of the core practicals, but also students’ ability to understand and apply the scientific method. We believe that this will result in valid assessments that genuinely do reward students who have engaged well with practical work.

Being able to withstand accountability pressures, that is, to avoid exerting unmanageable contradictions on teachers where they are acting as the assessor and being judged themselves through the outcomes of the assessments they make – the results of their students.

Removing controlled assessment will address many of these issues. These proposals should allow teachers to offer as broad a practical experience as possible. Better teaching of practical science, rather than narrow teaching of practicals will be rewarded in the outcomes of the assessments.

Question 4

Do you believe that there is an alternative option that can provide a better balance between these aims?

- Yes
 No

Question 5

If you responded 'yes' to question 4, which of the options below do you believe provides a better balance between these aims when used in addition to some science GCSE exam questions drawing on students' practical science experience

Please give reasons for your answer.

[] Option (i) science GCSE students' practical skills are directly assessed and marked and that mark contributes to the overall grade.

The practical skills are assessed by:

- () teachers observing students during the course*
- () a practical exam testing students' technical and manipulative skills*
- () an extended investigation including direct assessment of practical skills*
- () a portfolio of experiments, detailing methodologies, results and conclusions and including direct assessment of practical skills.*

[] Option (ii) science GCSE students' practical skills are assessed on a pass/fail basis related to competency with that outcome reported alongside the grade derived from their performance in the exams.

[] A different option that has not been covered in our consultation (please give full details of your proposed option).

Question 6

We have identified some ways in which our proposals for science GCSEs would impact (positively or negatively) on persons who share a protected characteristic. Are there any potential impacts we have not identified? If so, what are they?

- () Yes*
- (X) No*

If yes, please provide them here:

Question 7

Are there any additional steps we could take to mitigate any negative impact from resulting from these proposals on persons who share a protected characteristic? If so, please comment on the additional steps we could take to mitigate negative impacts.

Yes

No

If yes, please provide them here:

Question 8

Have you any other comments on the impacts of the proposals on persons who share a protected characteristic?

Yes

No

If yes, please provide them here: