A LEVELS – ARE THEY FIT FOR PURPOSE?

Meeting of the Parliamentary and Scientific Committee on Tuesday 15th July

Dr Michelle Meadows
Director of Research and Evaluation, Ofqual

It is worth asking first, what are A levels for? If you were to ask a sample of employers, university admissions tutors, teachers, pupils and parents you would hear many different but overlapping views. This is a problem. If a qualification tries to meet too many needs; if it lacks a clear purpose; it can fail to meet any of those needs.

A Levels have three primary purposes:

- **A Levels define and assesses the knowledge, skills and understanding needed to progress to undergraduate study**
- **A Levels provide a robust and internationally comparable post-16 academic course of study**
- **A Levels permit universities to identify learners' level of attainment**

But A Levels also have two secondary purposes:

- **A Levels provide a basis for school and college accountability measures**
- **A Levels provide a benchmark of academic ability for employers**

There are various methods by which Ofqual and other stakeholders assess the extent to which A Levels fulfil these purposes. One measure is public confidence. Ofqual conducts an annual survey and interviews with users of A level, including teachers, Higher Education Institutions (HEIs) representatives, employers and parents.

These data are from 2013. Confidence amongst HE and the teaching profession is high but it is noticeable that confidence amongst employers is significantly lower than in other groups. It is worth remembering that meeting the needs of employers is a 'secondary' purpose of the A level. A single qualification is unlikely to meet different needs to the same extent. Perhaps other ways of meeting employers' needs must be found? It is likely that employers require more than a benchmark of academic ability – measures of team working skills for example.

In fulfilling its purpose, the A level is not static. It is under constant review and frequently reformed. Setting aside the current reforms, significant changes have been made during the past 14 years. Before 2000 some modular A Levels existed (in particular in science) but in 2000 there was wholesale modularisation and the introduction of the AS qualification which students could undertake at the end of the first year.

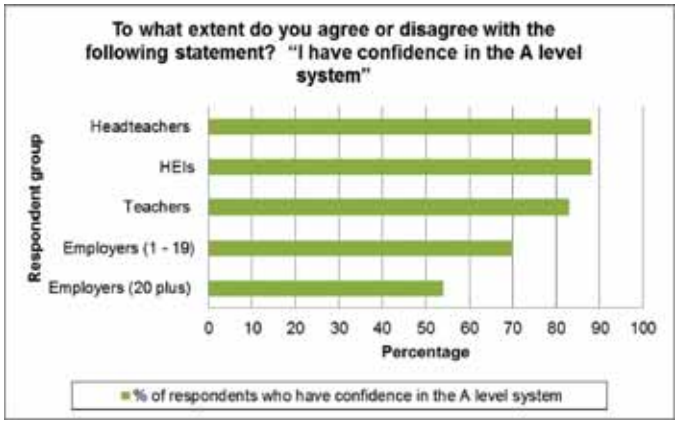
... A single qualification is unlikely to meet different needs ...

Modularity meant that some assessment could be taken every 6 months rather than all at the end of the 2 year course. Most A Levels were split into 6 modules. It was intended that this would motivate students and provide continual feedback. It quickly became clear that for most subjects, splitting into 6 assessments was too granular.

There was concern that this was affecting students' ability to develop in-depth knowledge and to draw links across subjects. In 2008, in most subjects, assessment was restructured into 4 modules but not in sciences or Maths. In science the 6 module structure suited the need for practical assessment.

At the same time more challenging assessment styles were included in the second year modules. Assessment which would require students to draw together knowledge from across the subject was introduced. The intention was to provide differentiation between students at the top end. A new grade was introduced to help universities select the very best – the A*. This was awarded for the first time in 2010.

However, these changes were insufficient to allay concerns over modular testing, and the sense that A Levels were not doing all they should to prepare students for undergraduate study.



Research conducted by Ofqual in 2012 involved interviewing HE representatives, employers and teachers. Some HE stakeholders argued that students on this diet did not develop a broad overview of a subject; that they lacked real understanding, and could not draw material together from across a subject. They complained that students lacked independent study and critical thinking skills.

They also felt that a re-sitting culture had developed. There was concern that this might have inflated grades, that students expected to have another go, and that getting a grade through repeated re-sitting was undermining that grade's value. Research based on one exam board's data from 2012 showed that 43% of A level candidates re-sat at least one of their modules, with almost a quarter re-sitting two or more modules. The strongest candidates, achieving the best grades, tended to re-sit the fewest modules.

Cambridge Assessment consulted 633 university lecturers. Over half of respondents thought that undergraduates were under-prepared for degree level study. They identified weakness in academic writing, self-directed study and independent inquiry, critical thinking skills, and depth of subject knowledge. Universities were putting on additional support classes for new students.

... Current assessments are open to malpractice...

What is being done to respond to these concerns? A Levels are being reformed from September 2015. In the meantime opportunities to sit modules have been removed. Exams can now only be sat in the summer. Effectively the AS and A level have become linear qualifications. More time will be available for teaching, and opportunities for re-sitting are much reduced.

The A level specifications from September 2015 are now being considered for Ofqual accreditation. All exams will be taken at the end of a two year course of study. This will support students in having a subject overview. Less time will be spent on assessment and more on teaching. Ofqual is scrutinising assessments to ensure they are not unduly predictable and that they will challenge the most able. We will only include teacher assessment where it is impossible to assess skills, knowledge or understanding validly without it. Where we can find methods of assessment that do not place pressure on teacher assessment, we have done so.

Overall the standard of the A level has not changed. We did not believe that there was a sufficient case to recalibrate the A level standard, as opposed to GCSE. The AS qualification still exists but its grading is decoupled from the A level – it will be a standalone qualification.

HE representatives have been involved in deciding the subject content for the new A Levels. They will be involved in reviewing the outcomes of the first awards.

There have of course been changes related to science A Levels. Some of these have been positively received. The maths content has been standardised across exam boards. Each science subject has a separate annex to the content setting out the maths that students will be required to master to at least level 2 (higher tier GCSE). This has been set at 10% for biology and psychology, 20% for chemistry and 40% for physics.

... a re-sitting culture had developed ...

Other changes have been controversial, in particular, the separate endorsement of practical skills. Students must carry out a minimum of 12 practical activities, which will be specified by exam boards. These will be assessed separately as pass or fail, rather than aggregated into the overall A level grade. Written exams will include questions (15%) set in the context of the specified or other practical activities. Students will only be able to do well on these questions if they have conducted a range of practical activities.

The separate endorsement of practical skills was a response to evidence of the current arrangements for assessing practical skills. The current assessments are predictable and have narrowed teaching. This is because the content of current tests is constrained by the limited time available for them to be completed; exam boards have to let schools know what's in assessments in advance so they can ensure they have the right equipment; and some schools only focus on teaching the skills they know students need to pass an assessment, rather than a broad range.

Most students get similar results, bunched around the top of the scale. This makes it difficult to differentiate students and grade boundaries. This makes for unreliable grading.

The marks do not reflect students' overall ability. They often get much better results in practical tests than written exams. Current assessments are open to malpractice. Different schools (and different students in the same school) might take the same assessments at different times. Schools get instructions for assessments in advance – this means some students and/or teachers might share information. Social media has exacerbated this problem. The way practical assessments are marked does not give evidence of the assessment of practical skills to check the marks teachers give students.

Stakeholders are concerned that this change will downgrade the importance of practical skills, meaning they are no longer taught within schools and colleges. The changes are intended to support the teaching of practical skills by removing them from the pressures of school performance measures.

This autumn the exam boards are trialling assessment methods and will be collaborating to ensure that a large sample of schools are visited each year to ensure that practicals are being conducted to an acceptable standard. They will be scrutinising student logbooks, talking to students and to teachers.

Ofqual will be conducting research to assess how well these arrangements are working and their impact on teaching and learning. We will also be talking to Ofsted about how to collaborate with exam boards to ensure these reforms have their intended impact. For science A Levels to be fit for purpose they must support good teaching and learning practical skills.

A LEVELS: Rearrange the deckchairs again or time for radical change?

Ian Haines
Executive Secretary, UK Deans of Science and Emeritus Professor, London Metropolitan University

LESSONS FROM HISTORY

Concerns over the state of school examinations have been a matter of debate for many years. A levels have been subjected to a two pronged attack over perceived grade inflation and questioning of the extent to which they prepare students for their future, whether this is for further study, usually in higher education, or directly into employment. In addition to the rhetoric in the popular press suggesting the annual grade inflation bore little relationship to the level of knowledge and understanding of students, there have been several studies that quantitatively indicated this. Two such STEM-related investigations that covered chemistry and mathematics are worth mentioning here.

In chemistry, the Royal Society of Chemistry carried out surveys[1] of entrants to about 40 Chemistry Departments. The study used the same standard test to measure the skills and knowledge of the core chemistry syllabus over the period between 1989 and 1996. Figure 1 compares the mean scores gained by candidates with the grade they obtained in A level chemistry. Over the period studied at all grade points there was a decline in percentage scores of at least one A level grade with those for B and C grades in 1989 having declined by over two grade points by 1996. The mathematics and engineering communities have had similar concerns. A mainly qualitative report[2] suggested problems of falling abilities of students with A level mathematics and the Engineering Council[3] showed comparable declines in mathematical skills in the 1990s to those observed for chemistry. These relatively historical reports are mentioned here simply to emphasise how long quantified evidence of problems with A levels has existed.

THE PRESENT AND FUTURE

Following many reviews, reports, workshops and conferences, too numerous to discuss here, the Secretary of State decided in 2012 to require Ofqual to 'consult' widely on A (and AS) qualifications. The consultation[4] was based on the importance of their use for entry to university, emphasising the need for increased rigour in the design and assessment of the curriculum, removal of the modular system with examinations only at the end of the course and non-exam assessment only allowed where this was absolutely necessary (as is the case of practical work in science). Much of what was suggested was broadly welcomed in principle by the STEM community, though many wondered why there was no serious questioning of why, after so many previous changes in A levels had failed to deliver better outcomes, he had not taken the opportunity to propose much more radical change. Of course, the consultation that followed contained questions that already assumed that A (and probably AS) level qualifications would remain.

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Ofqual has published[5] the results of their consultation, confirming most of the previously announced reforms with some additional conditions. These included the requirement that A and AS levels will be separate and freestanding and although AS may be taught

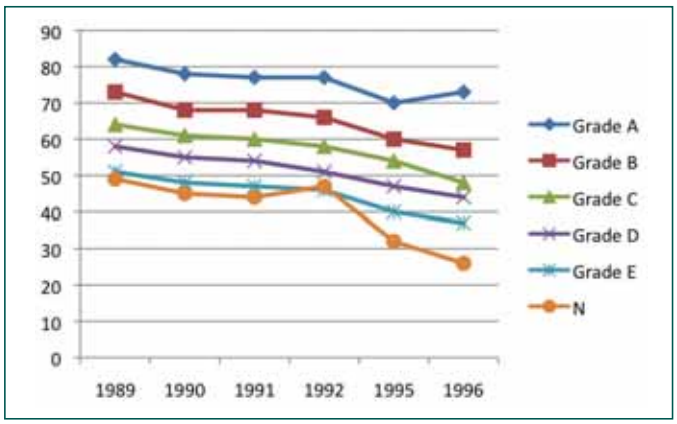

Figure 1 Mean scores in test versus A level grade of first year chemistry students

alongside A levels both will be assessed separately by written examinations at the end of the course. Each science A level will contain a minimum of 12 practical activities with at least 15% of written examinations consisting of questions that assess the 'theory and application of practical experimentation'. However, the practical skills will also be assessed and awarded a pass/fail grade, which will be reported separately from the written examination grade. It is this decision that is of particular concern for STEM subjects. Strangely, AS programmes in science will be assessed by written examination only.

Practical skills are as integral to science as they are to art and design. Decoupling of the reporting of practical skills at A level is an error of judgment by Ofqual. It is likely to give the wrong message about the importance of science practical skills to pupils, teachers, parents and school managers. There must be some concern as to how seriously the schools will take the need for resourcing and teaching practical skills if they are to be assessed purely by a pass/fail, 'tick the box' process. No matter how carefully the assessment criteria are defined, there will be a gradual move towards the 'bog standard pass'.

If we are to continue to have A and AS levels it is essential that manipulative skills and students' ability to plan, design, conduct and observe practical exercises, including fieldwork. They need to evaluate and explain the results obtained from their own work. This must be tested and graded beyond a simple pass/fail. The assessment of such skills should be integrated into the single overall grade awarded.

But surely it is time to stop fiddling with A levels and take the opportunity to think more radically.

TIME FOR RADICAL CHANGE? – SOME CASUAL EMPIRICISM

During the late 1980s and early 1990s Irish universities failed to keep up with the increasing demand for undergraduate places. I spent a number of years visiting Ireland to recruit Irish students to my university. The vast majority of students I met were far more articulate, confident and mathematically, and often scientifically, more advanced than many of their UK counterparts, in spite of the fact that they were studying a wider range of subjects than the typical three A levels. At the same time, some casual empiricism suggested that Scottish school leavers, who had also followed the broader Scottish Higher Certificate curriculum and were a year younger than A level school leavers, also appeared to be more intellectually prepared for higher education.

Region	Percentage of graduates in workforce
Inner London	60
Outer London	45
Scotland	41
South East	40
South West	37
East of England	36
Wales	33
North West	33
Yorkshire and the Humber	32
East Midlands	31
West Midlands	30
North East	29

Table 1 Percentage of working age population with a graduate qualification

It may be connected with these observations that Scotland has the third highest percentage of the working age population (defined as 21–64 for men and 21–59 for women) in possession of a degree level qualification[6] (Table 1). Also, although the PISA tables have some flaws and are intended to measure the effect of earlier schooling, 15 year-olds in the Republic of Ireland and Scotland generally outperform[7] those in England, Northern Ireland and Wales (Table 2).

Relative position	MATHS	SCIENCE	READING
1st	Rep of Ireland	Rep of Ireland	Rep of Ireland
2nd	Scotland	England	Scotland
3rd	England	Scotland	England
4th	Northern Ireland	Northern Ireland	Northern Ireland
5th	Wales	Wales	Wales

Table 2 Relative positions in PISA test 2012

... the wrong message about the importance of science practical skills ...

THE FUTURE. WHY A LEVELS?

The observations above indicate the clear advantages of a broad 14-19 education, which England, Northern Ireland and Wales would do well to copy in some form, whether this is simply a Baccalaureate or some other qualification. It would be better to make a decision about this now and not wait for the Baccalaureate to creep in over a period of years.

Why, ten years after the Tomlinson report[8], which was overwhelmingly supported by the STEM community, proposed a broader 14 to 19 curriculum are politicians and Ofqual still rearranging the deckchairs instead of facing the fact the A levels have had their day? The Government has handed over control of interest rates to the unelected Monetary Policy Committee and given regulation and control of the financial services industry to the independent Prudential Regulation Authority and Financial Conduct Authority. How long do we have to wait to have an independent STEM Education Authority (with representation from the major scientific and educational bodies, employers groups, teachers, trades unions, etc) with a remit to design, develop, introduce and oversee a more appropriate education system for the UK?

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4 Consultation on New A level Regulatory Requirements, Ofqual, 13/53302013,

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VIEWS FROM ACROSS THE SECTOR

Dr Sarah Main
Director, Campaign for Science and Engineering

The Campaign for Science and Engineering represents a broad membership of organisations in the science and engineering sector.

Our membership consists of around a thousand individuals and about a hundred organisations. Over half of the organisations are universities, spanning the range from research-intensive universities to 'access universities' who are interested in getting people via non-traditional routes into higher education. About a third of our members are learned professional societies. We have about 20 companies as members.

PRACTICALS ARE ESSENTIAL TO A LEVEL SCIENCES

NEEDS OF INDUSTRY

The subject area which has given rise to the most vehement responses from our membership is that of practicals.

All the industrial members of CaSE desperately want to be able to recruit people with practical skills across a broad range of jobs: from technical, to graduate and postgraduate levels.

It is so difficult to recruit people with the correct skills that they recruit from overseas. This leads them to talk about our migration policy and how it may better fit their needs. Jaguar Land Rover say that they are 'exporting GDP' because they have to recruit so much from overseas.

For undergraduate teaching, it is now so costly in terms of capital and teaching time that many universities are moving towards computer simulation in place of practical courses. The number of graduates coming through UK universities with hands-on skills is diminishing.

You may think that technician level skills do not directly impinge on A levels. However, there is an ageing demographic of technicians, and the pipeline of technicians is going to run out as they retire. It is important to consider the experience that is given to students throughout their school life because they may become the technicians of the future. They are as important as are graduates.

ENTHUSING YOUNG PEOPLE

There have been many studies by learned and professional societies, which seek to quantify the skills that the UK will need in the near future.

The Institution of Engineering and Technology says that we need to double the number of engineering graduates by 2020. *The STEM Human Capital Crunch* by the Social Market Foundation estimates that the skills shortage in science and engineering is 40,000 graduates per year. There is a movement to interest a more diverse range of people interested in science, technology, engineering and maths (STEM) subjects in order to provide the skills required in industry and academia. This movement seeks to broaden the appeal of science and engineering and increase the diversity of practitioners.

Several studies address how this might be achieved. For example, see Ofsted's 2013 report, *Maintaining Curiosity: a survey into science education in schools* and the Wellcome Trust's 2014 tool, *Questions for Governors.*

COST AND RESOURCES

It seems intuitive that practical experience in school is both motivating and a good learning tool. The Government introduced the Your Life campaign in June 2014. This recognises that we need more people with these skills.

In the week that this was introduced, with the aim of increasing by 50% the number of people taking maths and physics to A level, Ofqual announced the changes to practical assessment.

The changes being proposed may hinder the Your Life campaign. Schools are driven by league tables and performance measures, including A level grades. The Ofqual proposal includes taking practical assessment out of A level grades and awarding a separate pass or fail mark. Many schools are tight on time, resources and space. CaSE members are concerned that those schools might be motivated to use their limited resources to do well in A level grades, which are measured in league tables, directing resources away from practical skills, which are not.

The worst-case scenario is that Ofqual's proposed changes to science A level practicals will cause damage. Schools with ample resource will provide a rich practical experience of their own volition, and those schools with limited resources are less likely to provide this. This disadvantages those who are already worse off. We need to prevent the worst manifestation of this, which would be that science laboratories are turned into classrooms, easing pressure on school places at the expense of practical experiences because they are no longer included in A level grades.

EVERYONE NEEDS SOME SCIENCE AND MATHS SKILLS

A move towards maths and science education for everybody

up to the age of eighteen has been proposed. There is recognition that it is important for young people to acquire a range of skills across the disciplines, not only for university, but for employment. David Willetts, the former Universities and Science Minister, has championed this idea, saying that we as a country will do well if people enter into the workplace with a broad range of skills. The idea that all students should study maths in some format to the age of 18 is gaining traction. It would be worthwhile broadening the discussion to include science.

A levels are not everything. There is a move to ensure students have a breadth of education after the age of 16; and there are alternative paths to A levels. The boundaries between further education, higher education and life-long learning are increasingly blurred. To widen access into traditional higher education there must be many routes. Some of our university members are proud to facilitate alternative pathways.

THREE PRACTICAL IDEAS FOR THE NEXT TERM OF PARLIAMENT

CaSE will put forward three ideas before the next election.

Teaching science

In 2010, the Royal Society reported that only 6,000 science specialists were distributed over 17,000 maintained primary schools in England *(State of the nation report on 5-19 science and mathematics education)*. In 2013, a Wellcome Trust study showed that only around 5% of primary teachers had a science-related degree *(Building Expertise)*. Due to the scale of the gap, while seeking to increase the number of science graduates training as primary school teachers, it is essential that teachers without existing science specialism are trained as science subject leaders.

CaSE recommends that by the end of the next Parliament, every primary school should have a nominated science subject leader. (S)he does not have to be a science graduate but would be a contact person who would undertake Continuing Professional Development (CPD) to enhance their understanding of science and methods of teaching science in a primary school. They would be a link to the local community and would communicate with local businesses and colleges to bring an up-to-date experience of what science and engineering means in the area for that primary school. Having one in every school will foster connections which may not normally occur in every school. This would improve the perception of science and engineering at an early age.

The National Science Learning Centres do great work in this field. Their courses of professional development cost roughly £3,000 each. CaSE would like to see stable funding for eligible teachers to access CPD at these Centres.

CaSE wants to see science CPD become a normal part of a teaching career, so that teachers can update their experience of modern science and engineering. This needs to be accessible, through a Government commitment to funding, and school commitment to give teachers time to partake.

Studies show how children, particularly girls, respond well to the confidence of their teacher in their subject. Girls seem to be more likely to progress onto the next stage of science education if they have a confident teacher who has a higher qualification in the subject. Subject-specific CPD may encourage students to progress into further study. It can also build realistic and modern expectations of a career in science and engineering with teachers, students and parents.

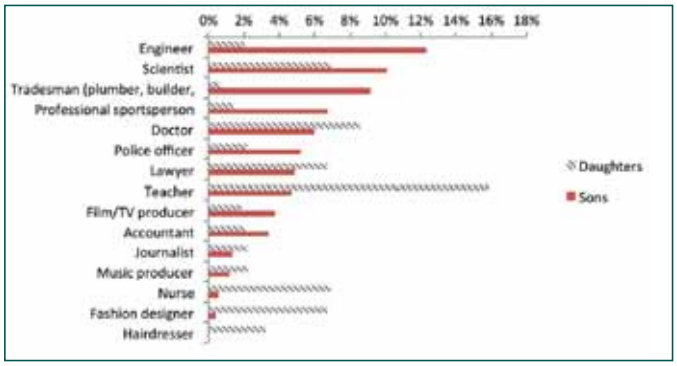
Parents' responses to the question, "What type of job would you most like your child to pursue when they finish their education?" show gender bias (from CaSE report *Improving Diversity in STEM*). CaSE believes that subject-specific CPD will help equip teachers better to convey the opportunities available to all through studying science and engineering subjects.

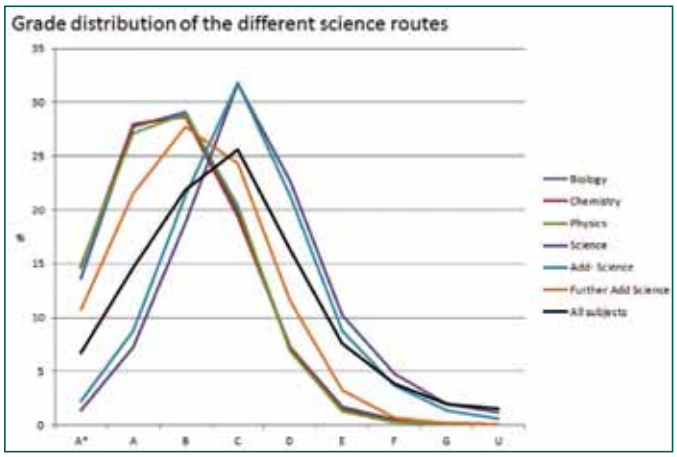
Practical science

All students should have practical experience at GCSE, AS and A level. Although we are talking about A levels, the issue about practicals also applies to GCSE and AS levels. The teaching and assessment of practical skills does not just mean written assessment, but an assessment of practical skills.

Studying science

All students should be able to study biology, chemistry and physics up to sixteen, and all should have the opportunity to study triple science up to GCSE level. The 2014 GCSE results suggest that students who take the triple science route achieve higher grades. We are told anecdotally that the triple science route is sometimes offered selectively to higher achieving students. CaSE would like all students to be offered the opportunity to study all three sciences at GCSE.





N.B. 'Science' – single award; 'Add- Science' is Additional Science – double award; 'Further Add Science' is Further Additional Science – triple award.