

Mr Chris Belsom
Chair, Schools and FE Committee
The Institute of Mathematics and its Applications
Catherine Richards House
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12 April 2010

Dear Chris,

Thank you for your letter of 16 March regarding the style of examination questions prevalent in GCSE and A-level mathematics.

Many of the issues you raise in your letter echo recent ACME position statements and submissions, and several have featured in relevant reports produced by other bodies – in that sense, the IMA is not alone in making these points and there is much that we share an interest in.

I will attempt to describe ACME's work in these areas and provide some commentary on your suggested solutions. In doing so, I should add that it is important to understand the influences at work in schools and not just the effects that they produce. It is these influences that need to be challenged; a single approach to counteracting the effects is unlikely to have much impact on improving the teaching of mathematics in schools in the long term.

ACME's work on the linked pair of mathematics GCSEs

As you will be aware, ACME has been working hard to ensure that the pilot of the linked pair of GCSEs is successful – part of this work has been in liaising with the Awarding Bodies participating in the pilot to ensure that the exam questions truly test mathematical understanding. We are pleased that you recognise the difficulties in grading questions which test application and multi-stage thinking – marking this style of question is a non-trivial problem which the Awarding Bodies preparing questions for the pilot of the linked pair are having to tackle. We recently organised a round-table discussion with the Awarding Bodies and other key stakeholders in mathematics education to share best practice and discuss some of the key challenges faced with the piloting of the linked pair. We would be happy to include you in future discussions on this issue.

Widening participation and the breadth of the cohort – a 'pathways' approach

We agree that examinations should provide a stretching problem-solving experience which promotes understanding and enjoyment of mathematics, but at the same time care must be taken not to construct an assessment system which would cause the majority of students to fail.

A major change in educational philosophy in recent decades has been the move towards widening participation in post-compulsory education, and I am sure that the IMA would

approve of the intended consequences for improving the general mathematical and numerical ability of the population as a whole. However, this is developing in a system that is not currently well-suited to implementing this philosophy, and the problems you refer to are being driven by the use of a single tool to stimulate, educate and assess an ever-broadening cohort.

The breadth of the ability of the cohort at GCSE - and even A-Level - means that it is impossible to provide for the mathematical needs of all learners through one qualification alone, and in this vein ACME supports the development of the Use of Mathematics A-level and has been arguing strongly for the retention of the Advanced Extension Award (AEA) or equivalent in mathematics at Level 3. Changes to any assessment system need to be incremental, but it might be that similar extension awards at GCSE would help with the necessary cultural shift without being unfair on those being assessed. ACME has been discussing the development of the Level 2 analogue of the Use of Mathematics qualification with Ofqual, and hopes that this will form part of the post-16 landscape in the future.

The need for suitable 'pathways' was a key recommendation of the Smith report in 2004, and ACME has recently been discussing what mathematical pathways should be available to post-16 learners in the context of all young people soon being required to continue with education or training up to the age of 18.

ACME believes that the commendable move towards widening of participation in mathematics education merits a corresponding increase in the range of examinations available, and that this will go some way to addressing the issues you raise.

Competition between Awarding Bodies and text books

Following the IMA statement on textbooks last year, ACME's submission to Ofqual's recent consultation *Regulating for Confidence in Qualifications* noted that the relationship between Awarding Bodies and publishers in endorsing text books was unhealthy and that there was no evidence to suggest that market forces help to raise standards. These issues were also referred to in the report of the DCSF/BIS Science and Learning Expert Group (see recommendation 12 and paragraph 103 of the report).

The commercialisation of examinations has much to answer for, but any new system must provide mechanisms for curriculum development (including its funding, and its follow-through to improve mainstream provision). ACME does not have a public position on what a new system for developing curricula and qualifications might resemble. However, we do believe that changes are necessary and that a debate is needed on what would constitute the most effective model that best addresses all of our concerns.

Some quarters have suggested the introduction of a single awarding body, but this runs the risk of stifling innovation. As you suggest, an alternative could be to franchise awarding bodies to run particular qualifications (e.g. GCSE, or A-Level), or perhaps even specific qualifications within subjects (e.g. GCSE Mathematics, or A-Level English). The franchise period could be for say five or ten years, and be governed by strict performance criteria. Indeed, the Sir Richard Sykes Report released earlier this month refers briefly to this model (p.6). However, there are clearly downsides to this in terms of curriculum development, and it is therefore important that a full and frank debate occurs, including subjects beyond just mathematics. A cautious approach is required here.

Exam style and assessment

Again, the IMA is not alone here in calling for exam questions that test a greater depth of understanding – I draw your attention to Recommendation 11 of the Science and Learning

Expert Group's report which relates to precisely this point, and to Recommendation 9, which proposes establishing standing STEM expert groups to advise on qualification and curriculum development; this could address your call for scrutiny of exam questions from the subject community.

ACME agrees that the current style of A-level and GCSE examinations – combined with pressures which have led to a culture of teaching to the test – prevents assessment from fulfilling its role in measuring the extent of a learners' understanding or motivating with a rich learning experience.

However, contrary to conventional wisdom we do not consider that there was ever a 'golden age' of assessment, or that we should return to past exam question styles – more challenging questions may have existed in the past, but it is less clear whether these were genuinely successful as questions. To be successful, a question must be accessible to some degree to the majority of learners, and it is for this reason that ACME advocates the continuation of the AEA-type qualification for those that are able to tackle more challenging problems.

I should highlight that following its Level 3 mathematics consultation last summer, QCDA intends to introduce 'stretch and challenge' material to A-Level mathematics and use the assessment of this material to determine the award of the new A* grade. However, we feel that the new grade – awarded for achieving an average of over 90% in the relevant units – will not be sufficient to differentiate at the highest level or provide the style of questions which the current AEA does without making A-Level inaccessible and reducing take-up. We are pleased that the Council for the Mathematical Sciences has joined us in calling for an AEA-type award to be retained; this provides very powerful support for ACME's position.

Regulatory issues are hampering the development of assessment. ACME believes that valid assessment requires instruments other than timed written examinations, but blanket rules determined by Ofqual permit only one mode of assessment per unit. This could stifle a number of potentially important qualifications.

We are also in the position where behaviour in the education system is being skewed by the high-stakes nature of league tables. The pressure for results is so great that no matter what style of exam question is used there will be a strong disincentive for teachers to depart from exam preparation.

These are complex issues which require careful analysis – I am sure you will appreciate that a thorough treatment of the various factors is necessary here. Your letter has prompted some interesting debate within the Committee which will inform future position statements.

Overall we share your concerns. This is an important debate and we value the interaction with IMA on these issues; we would be happy to accept your offer of a meeting to discuss this further, and I will ask Nick Bowes, the ACME Head of Secretariat, to contact you to find a mutually convenient date.

Yours sincerely,



Professor Dame Julia Higgins FRS
Chair, ACME

