

Dear Ministers,

Following our productive meeting on 1st September, I am writing to advise you of the progress made by the Expert Group on Science and Learning to date and outline the five priority areas where we intend to focus our attention as we move forward.

Key challenges and priorities

Science and mathematics are essential components of a broad and balanced education and central to a thriving modern economy. Good education in these subjects provides:

- knowledge and skills essential for everyday life and the ability to make well-informed decisions on a wide range of personal, family and social issues – finance, health, politics etc
- knowledge and skills needed in most jobs
- entry to specialist science, engineering and mathematical higher education and careers

None of these is more important than the others, but we have been asked to focus specifically on the science and mathematics education up to the age of 19 needed to secure the ongoing supply of highly-trained engineers, scientists and mathematicians.

This supply route is often referred to as the “STEM (Science Technology Engineering Mathematics) pipeline”, but is actually just one of the many interconnected educational pathways open to young people. Young people make their way guided by the own preferences, abilities, experiences and perceptions, and by the advice, information and judgements provided by parents, peers and professionals. The decisions and choices along the way are not straightforward and obvious. It is not a mistake to follow a pathway other than science – and it is certainly not “leakage” in a pipeline to move from science to other subject areas: these are legitimate choices.

Science and mathematics pathways in school need to become more effective at capturing young people’s interest early and translating this into achievement, progression and enthusiasm for STEM thereby influencing choices about higher education and careers. STEM learning brings access to a wide range of interesting, varied and fulfilling careers, and STEM graduates enjoy higher average earnings than most other graduates.¹ Yet many science and engineering first degree courses under-recruit and a significant

¹ a study by PWC for the IoP and RSC placed the earnings premiums for physics, chemistry and engineering degrees behind only those for medicine and law [*PriceWaterhouseCoopers, The economic benefits of higher education qualifications, 2005*].

number of employers continue to report difficulties in recruiting people with STEM skills.

STEM pathways must compete on their merits to engage and enthuse young people, both providing the motivation to succeed and delivering the learning necessary to do so.

Our approach to the enquiry

We are in the midst of conducting our enquiry. Here we set out our approach to our work. After initial meetings of the expert group to frame our areas of enquiry and identify key issues we have conducted an extensive consultation, which we plan to publish as part of our report. We have also undertaken an international comparison and literature review, since much has been published on the subject of science, engineering and mathematics education.

Our online consultation is complete and 129 written responses were received by the deadline of 18th September which we are in the midst of analysing. The extent of the response from across the school, further education, higher education and science communities has been gratifying and reflects the widespread interest and concern to strengthen science, engineering and mathematical education.

In addition to the online consultation we have held over twenty 'one-to-one' meetings with key stakeholders and the notes and letters arising from these will form part of the evidence in support of our eventual conclusions.

Finally we are planning a series of workshops between now and publication of our report in which we will test and challenge the direction and nature of our recommendations.

In this way we are planning that our recommendations will be supported by evidence and capable of implementation.

The main areas of our recommendations

Our consultation so far has identified the following key issues and concerns, that, although primarily relevant to potential high achievers in STEM subjects, in most cases are relevant to STEM education for all and in many cases to education in other subject areas.

Our respondents have all emphasized that teaching, the curriculum and assessment are intimately linked, and that deficiencies in any one of these domains has serious implications for the whole educational process. This is stating the obvious – but it is also clear from our consultation that whilst there are important opportunities in each domain, assessment has been identified as posing particular problems.

It is an inherent danger of any system of testing and assessment that this becomes ‘the tail that wags the dog’ – i.e. that education becomes focused predominantly or even solely on ensuring the best outcomes for participants in the tests. This is a difficult incentive to remove – and it therefore becomes paramount that the nature of the assessment and testing is driven by the primary educational aims. If this can be achieved, then ‘teaching to the test’ will deliver the education that is required. In this context our evidence shows that there is a perception that the present system of assessment and testing is not working as well as it could. In particular, many of our respondents note that the assessment and testing system has become removed from its key stakeholders, the school, further education, higher education and workplace communities. This is an area that we will focus on further as we develop our recommendations.

Science education is often considered in terms of ‘push’ – i.e. science and mathematics are ‘good things’ and a measure of success has to be to measure numbers of students studying these subjects and their levels of attainment. However, ‘pull’ mechanisms from higher education and the workplace are key to offering children at school the best opportunities to make their choices within the education system based on the best possible evidence.

Teaching success does not occur as a result of the isolated efforts of individual teachers. The environment in which education occurs, school or FE college is crucial. It has been apparent that the ethos of schools and FE colleges that are particularly successful in science and mathematics education is key to their success.

Following our stakeholder engagement and consultation, and based on research evidence and international comparisons, we have identified five priority areas where we intend to focus our attention and around which the final report will be structured:

- i. The STEM school and college workforce: the supply of science and mathematics teachers, continuing professional development (CPD) for science and mathematics teachers to promote high quality teaching and learning, strong subject leadership within schools and colleges, and mechanisms for collaboration amongst schools, colleges and higher education.
- ii. Curriculum delivery: the quality of teaching and learning and the classroom delivery of science and mathematics including considering the different pathways through the education system, engagement, motivation and enrichment, and stretch and challenge for the most able students.
- iii. Qualifications and Assessment: the impact on achievement and motivation of existing and planned science and mathematics qualifications, the extent to which key curriculum objectives are translated via the design of qualifications into outcomes for learners

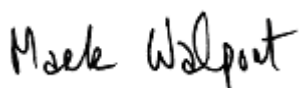
and the way that science and maths are assessed within schools and colleges affects students' ability to achieve and progress.

- iv. Market pull: how effectively the workplace and HEIs interact with schools and FE colleges, for example to communicate the value of STEM careers and to strengthen links between the various sectors. Our recommendations will touch on delivery of Information, Advice and Guidance.
- v. School and college ethos: enhancing the commitment of all schools and colleges' commitment to excellence in science and mathematics, and improving incentives to value and celebrate achievement and to encouraging participation and progression.

Although we are making excellent progress on developing recommendations in each of these areas, we do not wish to present these recommendations in a 'half-baked' form. We will continue to consult and refine our recommendations during the autumn, with the aim of presenting advice that is relevant, practical and achievable. We are aiming to produce a set of recommendations that will have a substantial impact to improve STEM education. We will deliver our report to Ministers early in the New Year.

I hope this is helpful and look forward to our next meeting, scheduled for 24th November.

Best wishes,



Sir Mark Walport
Chair of the Expert Group on Science and Learning