The Royal Society of Chemistry's response to National Discussion Scotland

December 2022

Introduction

We responded to Scotland's National Discussion on Education. The consultation was a response to Ken Muir's report Putting Learners at the Centre which recommended a national discussion in order to establish a compelling and consensual vision for the future of Scottish education.

In the response we offer our insights and viewpoint on issues such as sustainability in the curriculum, practical work, teacher workload and the importance of diverse role models in chemistry education.

1. *What kind of education will be needed by children and young people in Scotland in the future?*

The chemical sciences play a critical role in finding solutions to modern challenges and are essential for finding solutions to help build a sustainable future. Therefore, at the Royal Society of Chemistry (RSC), we believe that it is vital that chemistry education is fit for the future. Chemistry education should inspire all young people to be curious about the world around them, empower them to make decisions about their own lives and scientific developments impacting society, and equip them with the knowledge and skills to access further study and careers.

2. *How do we make that a reality?*

In our curriculum framework document 'The elements of a successful chemistry curriculum' [1], we raise the importance of chemistry education in addressing local and global challenges. In a recent survey conducted with 549 11-18 year-olds, only 38% felt that studying chemistry can lead to lots of jobs in sustainability and climate change [2].

Members of our teaching community highlighted the need for the curriculum in Scotland to focus on solving the problems of the future. They raised the need for sustainability to be a bigger focus in the curriculum, particularly in the senior phase. In our green shoots report [2], many educators identified a lack of time as a barrier to teach about climate change.

Therefore, we recommend that young people should understand the value of chemistry in society and to their future careers. This should be embedded into the curriculum as an expected learning outcome, without over-burdening students and educators with content. Teachers should also be supported to teach this content with resources and career-long professional learning (CLPL).

Literacy is also another important focus point in making this vision a reality. Members of our teaching community felt that the language used in science exam questions was often inaccessible, particularly for English as an Additional Language (EAL) and Additional Support Needs (ASN) students. We therefore support a focus on literacy within science lessons.

References:

[1] The Royal Society of Chemistry (2020), The elements of a successful chemistry curriculum: The Royal Society of Chemistry's vision for 11-19 chemistry education, https://www.rsc.org/globalassets/22-new-perspectives/talent/chemistry-curriculum-framework/chemistry-curriculum-brochure.pdf
[2] The Royal Society of Chemistry (2021), Green Shoots: a sustainable chemistry curriculum for a sustainable planet, https://www.rsc.org/globalassets/22-new-perspectives/sustainability/sustainability-curriculum/green-shoots-a-sustainable-chemistry-curriculum-for-a-sustainable-

3. *How can every child and young person's individual needs be supported and addressed in the future?*

Not answered.

4. *What is one thing that needs to stay and why?*

Our teaching community strongly believe that practical work must stay in the chemistry and science curriculum. Practical work offers learners the opportunity to understand the world around them and to learn skills that are useful for the further study of, and careers in, the sciences and beyond. The findings from the RSC funded, five-year study Chemistry for All: Reducing inequalities in chemistry aspirations and attitudes [1] echo the opinions of our teaching community and found that practical science enabled students to build their confidence, motivation and value in chemistry. We recommend that practical work continues to be an integral part of the sciences.

Our teaching community also highlighted the importance of focusing on sustainability and climate change in the curriculum. Our report on Chemistry's Contribution: Workforce trends and economic impact [2] emphasises the role of the UK's 275,000 chemistry using professionals in underpinning a diversity of economic sectors which will contribute to and undergo significant change in a low carbon or circular economy future; for example, oil and gas refining, chemical feedstock production, energy supply, waste and recycling and our world leading research organisations. With 79% of 11-18 year olds also seeing climate change and sustainability as a priority for the chemistry curriculum [3], we are calling on the Scottish Government to ensure young people have the skills and careers information needed to progress into green jobs in the chemical sciences and contribute to the future green economy.

References:

[1] Mujtaba T., Sheldrake R., Reiss M. (2020), Chemistry for All Reducing Inequalities in Chemistry Aspirations and Attitudes, https://www.rsc.org/globalassets/22-new-perspectives/talent/is-chemistry-accessible-for-all/rsc-cfa-report.pdf
[2] The Royal Society of Chemistry (2020), Chemistry's Contribution: workforce trends and economic impact, https://www.rsc.org/contentassets/8122a7694dd14a4f9779cec4e9dbb0a6/workforce-full-report
[3] The Royal Society of Chemistry (2021), Green Shoots: a sustainable chemistry curriculum for a sustainable planet, https://www.rsc.org/globalassets/22-new-perspectives/sustainability/sustainability-curriculum/green-shoots-a-sustainable-chemistry-curriculum-for-a-sustainable-

5. *What are the most important priorities for a future Scottish education system?*

In an unpublished survey conducted by the RSC, 'stress, exhaustion, burnout' (32%) and 'workload' (27%) were the reasons most often cited for why teachers wanted to leave the profession [1]. Those who received the least amount of subject-specific professional development expressed that they were more likely to leave the profession in the next five years [1]. Members of our teaching community called for more 'ring-fenced' time to complete CLPL and cited lack of time as an issue.

The important role of science technicians in delivering practical science education in the UK was highlighted in the 2017 the Good Practical Science report [2] by the Gatsby Foundation. The research drew on findings from international visits and qualitative interviews, concluding that 'technicians underpin most of our 10 benchmarks [for good practical science]'.

Unfortunately, the number of available technicians has been in decline for several years. A Freedom of Information request filed by the Scottish Labour party in December 2019 revealed there are the full-time equivalent of 879 STEM technicians currently working in Scottish schools, a decline of over 333 since 2010 [3]. The LSG examined the issue of reduced technician support in 2014. A commissioned survey undertaken by PyeTait showed a significant proportion of teachers (41%) were dissatisfied with the amount of technician support available to them [4].

Ensuring access to high-quality practical laboratory work is heavily dependent on technician presence and expertise. Appropriate action should be targeted towards increasing technician numbers and improving job security and satisfaction to ensure staff are retained over the longer term.

In our unpublished The Science Teaching Survey 2022, 48% of teachers in Scotland highlighted insufficient funding as a barrier to providing students opportunities to carry out practical work [5]. We recommend that the lack of funding in schools is addressed, so all students across Scotland have the opportunity to partake in practical activities within their science lessons.

It is extremely difficult for teachers to teach more than one course to different groups of students in the same room. This can result in inadequate supervision and less support being made available to students, as well as a correspondingly large increase in teacher workload. In an unpublished 2019 survey by the RSC Education Division Committee in Scotland, it was found that multi-course teaching took place in almost half of all secondary school classes in Scotland [6]. This was mostly seen at N4/N5. There are concerns from our teaching community that multi-course teaching is negatively impacting the quality of instruction and that the demands of teaching dual courses was contributing to excessive workloads. We recommend that if multi-course teaching is to take place, the N4 and N5 curriculum should be redesigned to make them more similar, with a core plus extension or foundation design, making it more accessible to teach.

The Curriculum for Excellence and associated restructuring of the senior phase has narrowed the number of subjects learners routinely study in S4, which in turn appears to be affecting uptake of STEM subjects at later stages [7]. From 2013 to 2018, entries to Higher Chemistry have declined by 6% while total entries to Higher qualifications have increased by 4.6% [8]. Other STEM subjects have seen even greater declines. To avoid this trajectory repeating itself, learners must be given adequate time in the curriculum to experience STEM subjects.

References:

[1] The Royal Society of Chemistry, The Science Teaching Survey 2022, (unpublished source); n=280
[2] Holman, J. (2017), Good Practical Science, https://www.gatsby.org.uk/uploads/education/reports/pdf/good-practical-science-report.pdf
[3] Scottish Parliament Official Report, 22 January 2020, p.37, https://www.parliament.scot/parliamentarybusiness/report.aspx?r=12471&mode=pdf
[4] LSG (2014), Resourcing School Science in Scotland: An Indicative Study of Primary and Secondary Schools (prepared by Pye Tait Consulting), Pye-Tait-LSG-Resourcing-Science-Report-November-2014.pdf (rsb.org.uk)
[5] The Royal Society of Chemistry, The Science Teaching Survey 2022, (unpublished source); n=479
[6] The Royal Society of Chemistry (2019), unpublished survey, classes containing N4 students: 92.7% were multi-level, n=273; those containing N5, 65.8% were multi-level, n=401
[7] Scott, J. (2018), Curriculum for Excellence and the Early/Middle Secondary Curriculum in Scotland: Lessons Learned or Forgotten?
[8] SQA attainment statistics for 2013 and 2018

6. *How can we ensure that everyone involved in education in Scotland has a say in future decisions and actions?*

Not answered.

7. *How can children and young people be cared for and supported in the future? (i.e. physical and mental wellbeing)*

Not answered.

8. *How can the right of every child and young person to have opportunities to develop their full potential be achieved in future?*

As mentioned in our response to Question 5, the curriculum should be designed to ensure that young people are given adequate time to experience STEM subjects.

Furthermore, young people should have access to a diverse range of role models (including across age, ethnicity, gender and other aspects of people's identities, characteristics, and circumstances) who are working within chemistry. The 'Chemistry for All: Reducing inequalities in chemistry aspirations and attitudes' [1] research found that some young women described the people delivering the Chemistry for All activities as positive role models. These role models can offer learners from disadvantaged backgrounds, who may have low science capital [2], access to an environment promoting chemistry achievement. The importance of role models in STEM subjects was echoed by our teaching community. These members of the teaching community advocated for student led mentoring schemes to help inspire younger students to study chemistry and bridge the gap between older and younger students.

References:

[1] Mujtaba T., Sheldrake R., Reiss M. (2020), Chemistry for All Reducing Inequalities in Chemistry Aspirations and Attitudes, https://www.rsc.org/globalassets/22-new-perspectives/talent/is-chemistry-accessible-for-all/rsc-cfa-report.pdf
[2] Science capital is defined as 'all the science-related interests, attitudes, resources, behaviours and social contacts that a person might have', Archer, L., Moote, J., MacLeod, E., Francis, B., & DeWitt, J. (2020), ASPIRES 2: Young people's science and career aspirations, age 10-19, https://discovery.ucl.ac.uk/id/eprint/10092041/15/Moote_9538%20UCL%20Aspires%202%20report%20full%20online%20version.pdf

9. *How can children and young people be helped to learn about our changing world, so they feel able to positively contribute?*

Members of our teaching community highlighted that there should be flexible routes into teaching to ensure a diverse teaching force. The demanding nature of the PGDE programme and the probation period was seen to be inaccessible to many people with caring responsibilities. There was also concern that much of the teacher training took place in the central belt and was inaccessible to people in more rural communities. The time trainee teachers and probationer teachers could be expected to commute was seen as a barrier and members of our teaching community suggested that the possibility of completing school placement blocks part-time during the PGDE and the option of a job-share during probation would make the training more accessible. A diverse teaching force is valuable in fostering social cohesion and most importantly, in supporting pupils to grow and develop in an environment of visible, diverse role models.

As mentioned in Question 2 of this response, we advocate for a curriculum in Scotland which includes a focus on solving the problems of the future to tackle climate change and sustainability challenges.

