

Royal Society of Biology response to Scottish Government's National Discussion on Scottish Education

5 December 2022

<https://www.gov.scot/news/national-discussion-on-education/>

The Royal Society of Biology responded to Scottish Government's call to inform the National Discussion on education. The National Discussion will inform wide-ranging plans, including the creation of three new education bodies and a review of qualifications and assessment.

RSB's education policy team sought input from members of RSB's Education and Science Policy Committee, Biology Education Research Group, Curriculum Committee and Education Policy Advisory Group to inform this response and drew on established policy positions that RSB has established across all four UK nations, as well as nation specific issues, previous publications and the work of other science organisations.

Alongside this individual Royal Society of Biology response to the national discussion, RSB is contributing to the Learned Societies Group joint response, which will also be published on RSB's and the Royal Society of Edinburgh's websites.

Background

Following Ken Muir's Education Scotland and Scottish qualifications authority review recommendations earlier this year, the Scottish Government opened up a National Discussion about the future vision of education in Scotland and the changes required to put this vision in practice.

As part of the Learned Societies Group in Scotland, the Royal Society of Biology submitted a [response](#) to Ken Muir's review of Education Scotland and Scottish Qualifications Authority, sent a [letter](#) to the Cabinet Secretary for Education and Skills on Scottish STEM Education in response to OECD's review of the Curriculum for Excellence, and shared [a briefing paper](#) on STEM education for those seeking election to the Scottish Parliament.

An independent review of qualifications and assessment is also taking place in Scotland, led by Professor Hayward, who is expected to make recommendations on the 3-18 Curriculum for Excellence and its four capacities to Scottish Government in March 2023.

<https://consult.gov.scot/education-reform/professor-haywards-independent-review/>

National Discussion on Scottish Education

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

In November 2021, the Royal Society of Biology published *Evolving 5-19 Biology: recommendations and framework for 5-19 biology curricula*, setting out RSB's vision for biology curriculum as defined in 7 big questions of biology, and set out 8 recommendations for policy makers and curriculum designers. We intend for this document to be a starting point for discussions around curriculum reform and would be happy to meet with Scottish Government officials to further discuss the framework.

Although the following recommendations are drawn from *Evolving 5-19 Biology (page 16+17)*, they are relevant to many subject areas; the biology curriculum content that is set out in policy and guidance documents should enable coherent learning progression from age 5-19; the development of biology curriculum policy, guidance and content should draw upon previous curriculum development work and evidence from research where appropriate; the biology curriculum content set out in policy and guidance documents should be clear, teachable and assessable, while allowing scope for innovation in delivery; the biology curriculum should be contemporary yet durable.

As part of the Learned Societies Group in Scotland, RSB has contributed to joint responses, letters and briefings regarding teaching and learning in Scotland. The Group has voiced concerns about the move away from principal subject teachers and how it is having an effect on teacher recruitment and retention and career progression. All children and young people should have equal opportunities in accessing high-quality subject teaching as part of their education. In secondary schools, science lessons should be taught by a teacher with a background in the specific science discipline and students should have access to an unbroken chain of specialised teachers. In primary schools, teachers should be given high quality support in the form of effective subject-specific continued professional learning – especially early in their career.

The future learning system will need a curriculum with input from teachers – teachers of the sciences and mathematics have expressed concern that curriculum reform has been undertaken with little input from the teaching profession, thus impacting on morale and teachers' professional status. The Royal Society of Biology supports an education system that enables all students to achieve the best possible outcome. This will be essential in tackling geographical disparities in productivity and earnings, and 'levelling up' opportunity across the nations and regions of the UK. In order for increased outcomes for children we need an education system that places the needs of the trainee teacher at the heart of any reforms and a framework for professional development that is open and permeable.

Learned Societies Group (2017) *Teaching Workforce Planning for Scotland's Schools Consultation response*

https://www.rsb.org.uk/images/LSG_Teacher_Workforce.pdf

Royal Society of Biology (2021) *Evolving 5-19 Biology: recommendations and framework for 5-19 biology curricula*

<https://www.rsb.org.uk/policy/education-policy/school-policy/curriculum>

The Gatsby Foundation (2021) *Reforming Teacher Training: Expert Perspectives*

<https://www.gatsby.org.uk/education/latest/itt-reform-more-reflection-needed>

2. How do we make that a reality?

The Royal Society of Biology strongly recommends that any reform of the education system in Scotland draws on best evidence for excellent teaching and learning in our subjects, and that curriculum reform is led by subject-based evidence rather than assessment principles. Good classroom practice and curriculum planning need to be shared locally and nationally using experienced and practising teachers across the STEM subjects. Such mutual knowledge and collaboration will help facilitate excellent teaching and learning. RSB notes that there is no mention of the subject-specific support that would be necessary to improve the capacity of teachers in curriculum making within their subject areas. The Royal Society of Biology strongly recommends that any new policies related to teaching and learning have a subject-focus. RSB, along with other science organisations in Scotland, would be happy to provide expertise and advice as part of reform discussions, including building on the recommendations in RSB's *Evolving 5-19 Biology: recommendations and framework for 5-19 biology curricula*. It is recognised that deploying teachers with strong disciplinary expertise has the greatest effect on student achievement in the STEM subjects. Teachers need significant time between announced changes and expectation of implementation to allow them to adequately prepare.

The Royal Society of Biology strongly supports primary-level STEM education and improving teacher knowledge and confidence, issues that were overlooked by the OECD review. The RSB urges the Scottish Government to consider the importance of subject knowledge for primary trainees, and ensure that all trainees wherever they are trained are able to access subject-specific support. It is essential that Initial Teacher Education (ITE) programmes are fit for purpose in adequately preparing student teachers to enter the workforce and teach confidently across the STEM subjects.

A strength of Scottish education is its relatively well qualified and committed teacher workforce with the requirement for degree level qualifications, ITE and probationary period, masters level qualifications for headship, and comprehensive GTCS Professional Standards. The Royal Society of Biology supports the Learned Societies Group in Scotland's concerns about the relatively low level of entrance qualifications in the STEM subjects for those entering primary teacher ITE and the variability of provision for the STEM subjects within primary ITE. In addition, recruitment of secondary teachers in most of the STEM subjects has consistently fallen below Scottish Funding Council targets for many years, and there continues to be a shortage of subject-specialist STEM teachers in Scotland. To maintain, and indeed enhance, Scotland's strong teacher workforce in the

STEM subjects it is important that flexible entry routes are explored, without a diminution of standards, and a national programme of high-quality subject-specific professional learning be developed to enhance the professional capacity of all teachers, not only within the STEM subjects.

The Royal Society of Biology believes that there should be subject-specific mentoring for teachers; for efficiency and effectiveness, it is essential for teachers to have access to people with expertise and knowledge in their discipline. RSB has drawn on a collection of essays collated by The Gatsby Foundation and focussing on issues in the English Initial Teacher Training system, however the views provided by these experts draw on best evidence and research, and make valuable recommendations that can be applied in Scotland. Targeting investment in the existing teaching workforce through high quality support for teachers within their subjects, in the form of effective subject-specific continued professional learning – especially early in their career – and ensuring all students have access to high-quality subject teachers will strengthen the education system and improve educational outcomes.

OECD (2021) *Scotland's Curriculum for Excellence report*

<https://www.oecd.org/education/scotland-s-curriculum-for-excellence-bf624417-en.htm>

Institute of Physics (2020) *Subjects Matter*

<https://www.iop.org/about/publications/subjects-matter>

Learned Societies Group (2019) *GTCS Professional Standards*

<https://rse.org.uk/expert-advice/advice-paper/lsg-response-gtcs-consultation-professional-standards-new-code/>

Learned Societies Group (2020) *SQA consultation on assessment modifications*

<https://rse.org.uk/expert-advice/advice-paper/lsg-response-sqa-consultation-proposed-modifications-nat5-higher-advanced-higher/>

Learned Societies Group (2021) *Briefing to MSPs on Scottish STEM education*

https://www.rsb.org.uk/images/LSG_Teacher_Workforce.pdf

Learned Societies Group (2021) *Response to Professor Ken Muir's education reform consultation*

<https://rse.org.uk/expert-advice/advice-paper/learned-societies-group-response-to-professor-ken-muir-education-reform-consultation/>

Royal Society (2021) *Science Education for a Research and Innovation Economy*

<https://royalsociety.org/topics-policy/publications/2022/science-education-for-a-research-and-innovation-economy/>

Royal Society of Biology (2021) *Evolving 5-19 Biology: recommendations and framework for 5-19 biology curricula*

<https://www.rsb.org.uk/policy/education-policy/school-policy/curriculum>

Scottish Government (2021) *Curriculum for Excellence: Scottish Government response to OECD Review*

<https://www.gov.scot/publications/oecd-review-of-curriculum-for-excellence-scottish-government-response/>

Scottish Government (2021) *Initial teacher education: 2020 student teacher intake statistics*

<https://www.gov.scot/publications/initial-teacher-education-2020-student-teacher-intake-statistics/pages/pgde-secondary-and-alternative-route-intake-figures/>

Scottish Government (2022) *Teacher Workforce Planning Advisory Group: initial teacher education intake figures 2021*

<https://www.gov.scot/publications/teacher-workforce-planning-advisory-group-initial-teacher-education-intake-figures-2021/>

The Gatsby Foundation (2021) *Reforming Teacher Training: Expert Perspectives*

<https://www.gatsby.org.uk/education/latest/itt-reform-more-reflection-needed>

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

The Royal Society of Biology supports the sentiment and encourages Scottish Government to conduct equality and diversity impact analysis on any new education and qualification proposals. The Society would be happy to engage further on this during the development of science curriculum and assessment, and teaching and learning policies.

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

Along with our Learned Societies Group partners, the Royal Society of Biology recognises the importance of practical work in primary and secondary bioscience education. Practical work is a vital component of a high-quality STEM education. Learners who are given a chance to consolidate and apply theoretical concepts in a practical setting display better engagement and knowledge retention than those that do not. It can also encourage curiosity and a keenness to learn among pupils for whom classroom-based STEM learning is less motivating. Undertaking practical work at the secondary level can also ease the transition into the more demanding pace and depth of learning undertaken in tertiary education. The COVID pandemic severely impacted learners' access to practical laboratory work, the effects of which are still being remediated. LearnSci surveyed teachers from around the world to ask about the observed impacts of disruptions to practical lab work among their students. Responses included a drop in tactile and manipulative motor skills; weaker experimental design; the loss of basic lab skills; poorer team-working skills; and reduced confidence. Recommendations were also made for how first-year STEM university educators could accommodate and address these deficits. Practical work can also be beneficial for the personal and professional development of the teacher, particularly at the primary school level.

This is not to suggest that there is no room for improvement. Not all practical work is alike and some methods are more effective than others. The Royal Society of Biology would therefore like to see an enduring commitment to the principle of practical work, both classroom and field, with the scope to make changes where current approaches are found to be inadequate. This will necessarily vary by subject.

Institute of Physics (2018) *Practical work in science: a report and proposal for a strategic framework*

<https://www.iop.org/sites/default/files/2019-09/practical-work-in-science.pdf>

LearnSci (2021) *Recent practical science school lessons and the challenge faced by first-year university STEM teaching staff*

<https://www.learnsci.com/post/recent-practical-science-school-lessons-and-the-challenge-faced-by-first-year-university-stem-teaching-staff>

Martínez-Borreguero, G.; Naranjo-Correa, F.L.; Mateos-Núñez, M (2022) *Cognitive and Emotional Development of STEM Skills in Primary School Teacher Training through Practical Work*

<https://www.mdpi.com/2227-7102/12/7/470>

Ofsted (2021) Research review series: science

<https://www.gov.uk/government/publications/research-review-series-science/research-review-series-science>

STEM Learning (2009) *Getting Practical: A Framework for Practical Work in Science*

<https://www.stem.org.uk/resources/elibrary/resource/33090/getting-practical-framework-practical-work-science>

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

Scottish education will benefit from a curriculum and associated subject-specific pedagogy that is informed by subject experts, research and best evidence for excellent teaching and learning in the subject. Teaching and learning should not be adversely impacted or dictated by the corresponding system of qualifications and assessment for certification. The Royal Society of Biology has spent time developing a curriculum framework to inform education reform in Scotland and other UK nations. This framework draws on the disciplinary expertise of our members and committees, as well as expert input on teaching and learning. Furthermore, the Royal Society of Biology believes that there must be a parity of esteem between academic and technical qualifications and equal support for pupils on academic or vocational routes. There must also be equity of provision of resources, opportunities, etc. across all regions of Scotland. A good science education includes the study of the real world outside the classroom in a range of environments, and this is particularly true of biology and ecology. Therefore, we welcome the announcement in A Fairer, Greener Scotland: Programme for Government that **“We will make sure that pupils from lower-income families can take part in school trips**, providing support for children to go on curriculum-related trips and activities, and Primary 6/7 residentials, and giving secondary school pupils the right to go on at least one "optional" trip during their time at school.” This should remain a priority as, for disadvantaged

learners in particular, a school field trip might be their only opportunity to study the natural world. Such an important part of science education should not be left to chance, or become the reserve of those who can afford it.

In order to achieve these priorities, and after discussions with fellow science organisations, the Royal Society of Biology recommends that there must also be an investment in teachers and teaching quality – this will result in improved efficiencies in training and reductions in attrition - both of which will reduce recruitment costs. In the longer term it will improve student outcomes in the sciences. The Royal Society of Biology also recommends establishing an entitlement for teachers so that at least half of their professional development and learning is subject specific. There needs to be specific support for teacher continued professional development to update their knowledge in their subject to make their teaching research/knowledge-informed, and specialist input into any curriculum development – this is imperative for science teaching as it is easy to become quickly out of date in advances in subjects.

Institute of Physics (2020) *Subjects Matter*

<https://www.iop.org/about/publications/subjects-matter>

Royal Society of Biology (2021) *Evolving 5-19 Biology: recommendations and framework for 5-19 biology curricula*

<https://www.rsb.org.uk/policy/education-policy/school-policy/curriculum>

Scottish Government (2021-22) *A Fairer, Greener Scotland: Programme for Government*

<https://www.gov.scot/publications/fairer-greener-scotland-programme-government-2021-22/>

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

Scottish Government should engage with employers, tertiary education institutions and other relevant stakeholders to get a wider picture of needs. In development of teaching and learning policies and proposals for reform, close links should be sought with subject associations and professional bodies to define and support the subject aspects of a teachers' professional learning, certify and accredit professional development leaders, and drive innovation in professional development. The Royal Society of Biology supports the need for coherence between the Standards and the Professional Review and Development and Professional Update processes to ensure that primary teachers and secondary teachers in the STEM subjects are able to access career long professional learning in STEM concepts, content and pedagogy.

We also believe that it is important to get input from teachers about the curriculum they will be teaching. This review should offer both opportunities for wide consultation but also bring those with appropriate knowledge and experience together, drawing from classroom teachers, school leaders, academics with appropriate research, curriculum, and pedagogical knowledge, as well as other stakeholders, to ensure curriculum and assessment reviews result in changes of a high but realistic standard.

Learned Societies Group (2017) *Teaching Workforce Planning for Scotland's Schools Consultation response*

https://www.rsb.org.uk/images/LSG_Teacher_Workforce.pdf

Learned Societies Group (2019) *GTCS Professional Standards*

<https://rse.org.uk/expert-advice/advice-paper/lsg-response-gtcs-consultation-professional-standards-new-code/>

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

The RSB does not offer a particular position on this question, other than to agree with the general premise and note that physical and mental ill health and wellbeing are included in our curriculum framework, *Evolving 5-19 Biology*. We would welcome further discussion with Scottish Government in the context of bioscience learning and teaching.

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

The Royal Society of Biology supports the right of every child and young person to have opportunities to develop their full potential, particularly from a STEM perspective. The Society supports the fact that young people should be able to access a wide range of learning and career opportunities. In addition to facilitating access to STEM opportunities, young people should be provided with comprehensive and accurate careers advice to illustrate the wide array of STEM pathways and destinations available to them.

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

The Royal Society of Biology believes that the curriculum should provide pupils of all ages with ample opportunities to learn about plants and other organisms, in addition to humans and other animals. Any new curriculum should be informed by best evidence and practice for subject-led teaching and learning. The Royal Society of Biology recently published a recommendations and a framework for biology curricula – *Evolving 5-19 Biology*, and would be happy to meet with those leading on curriculum reforms to discuss further.

Furthermore, the curriculum should provide ample opportunities to engage in practical and investigative work, including in the field. Field classes, practical work and visits to relevant organisations should be encouraged and supported to enable student to experience and understand how the theory they are learning is applied in the real world - this is particularly important for inner city schools where teachers may find opportunities for outdoor learning limited. Students should be given equal opportunities to succeed in sciences so they feel confident in contributing, with specific

consideration of accessibility for students in more deprived areas; if not, the nation is missing out on the diversity of creative minds that drives innovation.

The Royal Society of Biology maintains that high-quality biology education can provide the fundamental building blocks to understanding the living world and our impact on it. It also provides hands on experiences to learn about nature. Therefore, RSB recommends that Learning for Sustainability continues to form an important component of Curriculum for Excellence and should remain as its cross-curricular approach weaves together global citizenship, sustainable development education and outdoor learning. It supports the development of knowledge, skills and values at the heart of the curriculum's four capacities and provides a way to promote and work towards the UN's Sustainable Development Goals.

The Royal Society of Biology supports the opinion that the STEM aspirations of young people (and their families) need to be supported from the earliest years in order to build the 'science capital' required. There is a shortage of STEM graduates across a wide range of sectors, including teaching, therefore RSB supports improving progression into STEM subjects and careers, while also closing the attainment 'gap' between the most and least disadvantaged children; providing high-quality STEM provision for young people at all levels of education; attracting and retaining teachers and supporting career-long professional learning for all practitioners, including in STEM.

Learned Societies Group (2017) *Teaching Workforce Planning for Scotland's Schools Consultation response*

https://www.rsb.org.uk/images/LSG_Teacher_Workforce.pdf

Learned Societies Group (2021) *Briefing to MSPs on Scottish STEM education*

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Royal Society of Biology (2021) *Evolving 5-19 Biology: recommendations and framework for 5-19 biology curricula*

<https://www.rsb.org.uk/policy/education-policy/school-policy/curriculum>

10. Do you have any other comments that you would like to provide about a vision for the future of Scottish Education?

The Royal Society of Biology believes that any education reform should consider progression into post-16 and progression to higher education to make sure there is continuity between each stage of education. Between 2013 and 2018, the number of entries for STEM based subjects at SCQF underwent a noticeable decline. Computing-related entries decreased by 44%, chemistry entries by 27%, both physics and biology went down by around 22% and entries to maths by around 11%. Over the last few years there has been a swing in entry numbers from Higher Biology to Higher Human Biology – the reasons for this and implications on progression should be investigated, and the Royal Society of Biology would be happy to assist.

The Royal Society of Biology, through key roundtable discussions with our colleagues in the other science organisations, believes that the investment in teachers and teaching quality will provide

returns through immediate efficiencies in recruitment and in lifetime earnings of students. Raising teachers' professional status is key to addressing teacher shortages, with teacher professional status and supply being fundamentally linked - high-quality initial teacher education and career-long professional development, including that which is subject- specific, are key components to this. Career-long professional learning (CLPL) is also a key determinant of teacher empowerment, facilitating a better understanding of how to allocate time and resources, structure learning, adapt to change and participate in decision making at the school level and beyond. Furthermore, CLPL can be key in the recruitment of STEM teachers, which is a fundamental challenge impacting on learner outcomes and STEM skills development.

Education Scotland (2022) *The Structural Barriers to STEM Engagement*

<https://education.gov.scot/media/0xdf5sw/ekosgen-structural-barriers-to-stem-engagement-year-3-report-nov-2022.pdf>

Learned Societies Group (2017) *Teaching Workforce Planning for Scotland's Schools Consultation response*

https://www.rsb.org.uk/images/LSG_Teacher_Workforce.pdf

Learned Societies Group (2019) *GTCS Professional Standards*

<https://rse.org.uk/expert-advice/advice-paper/lsg-response-gtcs-consultation-professional-standards-new-code/>

Learned Societies Group (2019) *Subject choices: a response from the learned societies' group on Scottish STEM education to the Scottish parliament's education and skills committee*

<https://rse.org.uk/expert-advice/advice-paper/lsg-response-scottish-parliament-education-skills-committee-inquiry-subject-choice-secondary-school/>

Scottish Government (2017) *Science, Technology, Engineering and Mathematics: education and training strategy*

<https://www.gov.scot/publications/science-technology-engineering-mathematics-education-training-strategy-scotland/>