LEARNED SOCIETIES' GROUP ON SCOTTISH STEM EDUCATION:

A RESPONSE TO THE SCOTTISH GOVERNMENT'S DRAFT STEM EDUCATION & TRAINING STRATEGY

January 2017

Summary

› *The Learned Societies' Group (LSG) welcomes the Scottish Government's commitment to bringing forward a STEM Education and Training Strategy. However, we would have expected the strategy to draw more extensively and explicitly on the many constructive, specific and evidence-based suggestions of the STEM Education Committee (STEMEC) final report. We would not wish the STEM strategy to be a missed opportunity in this regard.*

› *There is a need to ensure coherence and coordination across all relevant Government strategies and frameworks, including the STEM Strategy, National Improvement Framework (NIF), Making Maths Count initiative, Developing Scotland's Young Workforce and School Governance Review. While these developments are mentioned within the STEM strategy, the strategic nature of these connections needs to be strengthened.*

› *Notably, the Deputy First Minister has stated that he is prioritising the NIF focus on literacy, numeracy, and health and well-being over science. While it is absolutely right that Government should articulate priorities, it needs to be alive to the consequences of this decision for STEM subjects, and the signal this sends out to learners, parents and schools, in particular.*

› *The draft strategy presents an impressive list of existing and proposed actions. Careful attention needs to be given to the criteria used for their selection, how they are to be implemented and how they will be assessed. Identification of appropriate and measurable criteria for assessing progress will be central to realising the strategy. Appropriate baseline data will need to be identified and collected. This demonstrates the need for an implementation plan at a far more specific level of detail than is present in the current strategy. The LSG would be pleased to contribute to its development.*

› *Consideration should be given to whether there is a way in which the range of STEM activity and engagement could be mapped to support a better understanding of what is available and where, and to identify duplication and/or gaps in provision and access.*

› *We are clear that gender stereotyping needs to be tackled across the whole school environment as responsibility for this does not rest solely with the STEM subjects. It also extends beyond encouraging more girls in to STEM.*

› *While the importance of Mathematics in underpinning STEM is clearly stated, using this as a definition of Mathematics is too limiting. Similarly, the strategy needs to recognise Computing Science as being distinct from the focus on digital skills. Both Mathematics and Computing Science should be reflected in the strategy as being disciplines in their own right.*

› *While the strategy rightly recognises the importance of STEM from the economic and employment perspectives, care needs to be taken to avoid an instrumentalist approach. STEM education in itself is invaluable in terms of helping to develop well-rounded, informed and enquiring citizens.*

› *A priority will be to ensure that young people perceive STEM as being for "people like me". ASPIRES research shows that while most primary school age children like science, very few of them aspire to work in science. Family 'science capital' is a key influence. There is a need to promote the message that STEM provides transferable skills that enable people to keep their career options open.*

Summary continued

> *The strategy recognises that teacher competence has the greatest effect on student achievement, with the early and primary years being particularly crucial for STEM. High-quality initial teacher education and ongoing subject-specific professional development are central to this. We strongly recommend that the planned review of the content of ITE programmes should be extended to consider STEM provision within the primary programmes.*

> *The Government needs to make clear what value will be added by the proposal to establish a Scottish STEM ambassador network in addition to the UK programme which currently operates in Scotland. Strategic clarity is required to ensure efficient use of limited resource and to avoid confusion.*

Introduction

1. The Learned Societies' Group (LSG), which brings together the learned societies and professional associations with a focus on the provision of STEM at school[1], is pleased to respond to the Scottish Government's consultation on the draft STEM Education and Training Strategy[2]. We welcome the Government's commitment to bringing forward the strategy as a means of developing a systemic approach for the provision of STEM education and training in and across Government, its agencies and other partners.

2. We welcome the fact that the Chief Scientific Advisor (CSA) has been involved in preparing the draft strategy. It will be crucial to ensure that its development takes full account of the evidence base and expertise which is available to the Scottish Government. We were disappointed to learn that the Scottish Science Advisory Council (SSAC), Scotland's highest level science advisory body whose role is to provide independent advice to the Government, was not invited to contribute to the development of the draft strategy prior to its publication. We very much hope that the Government will seek input from the SSAC as the strategy is further developed.

3. The STEM Education Committee (STEMEC) submitted its final report[3] to the Government in May 2016 which set out 43 evidence-based recommendations for securing continuing improvement of Scottish STEM education. The development of the STEM strategy presented an ideal opportunity to build on the many constructive and specific suggestions made by STEMEC. However, we are concerned that the draft strategy is a missed opportunity in this regard as it makes only passing reference to STEMEC's final report.

4. Many of the recommendations and issues raised in the STEMEC report had been highlighted by the work of its predecessor in the Science and Engineering Education Advisory Group (SEEAG) Report of 2012. Going back further, the SSAC report of 2003, *Why Science Education Matters*, also made recommendations for supporting and improving science education in schools. What these reports demonstrate, along with regular Government and Parliamentary consideration of these issues, is that there is a consistent view over a reasonably long timeframe of the main issues which need to be addressed in improving the delivery of STEM education. The challenge for the Scottish Government will be to marshal the output of these reports and related developments in the form of a cohesive and comprehensive strategy for Scotland. This will require a focus on the processes by which strategic, system-wide change can be implemented. As part of this, it will be important that the STEM strategy makes strategic connections to other relevant Government strategies and frameworks, including the National Improvement Framework (NIF), the *Making Maths Count* initiative and the ongoing review of school governance, among others. While these developments are mentioned within the document, the strategic nature of these connections should be strengthened. We believe that a coordinated strategic approach across Government and its partners will be crucial in order to ensure effective progress and avoid the creation of unhelpful silos.

1   More information about the work and membership of the LSG is available at: https://www.rse.org.uk/policy/standing-committees/learned-societies-group/

2   Draft STEM Education and Training Strategy; Scottish Government; November 2016; http://www.gov.scot/Resource/0050/00509522.pdf

3   Final STEMEC Report; May 2016 http://www.gov.scot/Topics/Education/Schools/curriculum/STEM/STEMEC/Report/FinalSTEMECReport

5. While the current draft sets out an extensive range of actions, great care needs to be taken so as to ensure that the actions identified are appropriate. There is currently a clear gap within the strategy between the outcomes and actions identified, and the way in which progress towards their achievement will be assessed. This is understandable since it is an early draft. However, it is crucial that all those whose actions will be defined by the strategy are clear on what is expected of them. This demonstrates the need for an implementation plan at a far more specific level than the current strategy, making clear the success criteria, notably those which are quantifiable, key timelines and staging posts, and who will be accountable for delivery. The LSG would be pleased to contribute to the development of an implementation plan.

6. The lifespan of the strategy should be clarified as the current version makes a number of references to the CSA by name. We anticipate that the intention is for the strategy to remain in place beyond the term of office of the current CSA. This raises the related question of how does the Government intend to review and, as necessary, modify the strategy to ensure it remains fit for purpose.

7. We have not commented on every consultation question and, where we have considered it appropriate to do so, have grouped together related questions. We should be pleased to discuss our response with the Scottish Government and look forward to contributing to further iterations of the strategy.

Question 1: Do you agree with the definition provided of STEM for the purposes of this Strategy?

8. We recognise the challenge of trying to set out a comprehensive definition of STEM and we should not like progress on the strategy to be compromised by an undue focus on definitional detail. We are supportive of the need to develop an inclusive approach to STEM. Having said that, it will be important that the strategy makes clear that 'STEM' is not a single entity; rather, it is a framework which comprises distinct disciplines which have their own unique characteristics, opportunities and challenges.

9. In addition, we believe that the definitions would be improved by:

> Ensuring that *Computing Science* is recognised as being distinct from the focus on digital skills. While we understand that there is a societal need to develop digital skills, we are concerned about 'digital skills', 'ICT' and 'Computing Science' being considered by some to mean the same thing with the terminology used interchangeably. As the Government is aware, there is a pressing challenge to address the way in which Computing Science is perceived and provided for at school, especially as a recent study indicates that 17% of secondary schools in Scotland do not have a Computing Science teacher [4]. This needs to be considered against the backdrop of the considerable employment opportunities afforded to those with grounding in Computing Science. Computing Science is a discipline in its own right and this needs to be reflected in the strategy if these issues are to be tackled.

> While the importance of Mathematics in underpinning STEM is clearly stated, using this as a definition of Mathematics is too limiting – it does not, for example, reflect the fundamental role of the Mathematical Sciences in economics and finance. Mathematics and Statistics are disciplines in their own right and this needs to be reflected in the strategy.

> While the definition for Engineering states that it "solves real-world problems", this is not included in the Science definition. Inadvertently, this could imply that science is concerned only with theoretical and/or abstract issues. Clearly, the strategy does not intend to give this impression and it should be strengthened by reinforcing the role of science in addressing current and future global challenges.

> In none of the definitions is there reference to the 'creativity' which is vital to STEM. This could be easily remedied by drawing upon the Minister's Foreword to the strategy which does highlight STEM as being underpinned by creativity and curiosity. In addition, insertion of the word 'manipulation' within the science definition would reinforce the creative component.

4 Computing science teachers in Scotland 2016, Computing at School Scotland. http://www.cas.scot/wp-content/uploads/2016/08/ComputingTeachersinScotland-CASSReport2016.pdf

Question 2: **Do you think the aims of this Strategy and the four priority themes are the right ones to address the challenges identified?**

10. We are comfortable with the aims of the strategy since they focus on the twin requirements of improving the population's STEM engagement and knowledge generally, while also recognising the need to facilitate more specialist skills within STEM areas. However, we do note that there is a tendency throughout the draft to focus on the economy and employment as the key drivers for STEM. While they are undoubtedly very important, care needs to be taken to avoid an instrumentalist approach. STEM education in itself is invaluable in terms of helping to develop well-rounded, informed and enquiring citizens.

11. As we have stated in our introductory remarks, there is a need to ensure strategic coherence across the relevant Scottish Government frameworks. The Government will be aware that drawing upon Wellcome Trust research [5] on the use of Standard Assessment Tests (SATs) in England, the LSG has raised concern that the overriding focus of the NIF on literacy, numeracy, health and wellbeing could have adverse implications for the way in which science education is perceived and delivered. At the *Science and the Parliament* event [6] in November, the Deputy First Minister confirmed under questioning that he is prioritising the NIF areas over science. While it is absolutely right that Government should articulate priorities, it also needs to be alive to the consequences of its decisions for other areas, including the sciences, and the signals that this message sends out, particularly to learners, parents and schools.

12. In relation to the *Equity* priority, it should be recognised that gender balance challenges are not uniformly applicable to all STEM areas. This reinforces the point we make in response to question one on the need for the strategy to recognise the distinct opportunities and challenges within the individual STEM disciplines, and the fact that a "one-size-fits-all" approach would be inappropriate.

13. Launched in December 2015, *Improving Gender Balance Scotland* is a joint partnership programme from Skills Development Scotland (SDS), the Institute of Physics and Education Scotland. It seeks to challenge stereotypes, prevent early bias in career choices and break down barriers to support diversity in STEM subjects in schools. The evaluation of this pilot project will be useful in helping to inform the STEM strategy. We also welcome the work of the Scottish Funding Council (SFC) in bringing forward a gender action plan for addressing gender imbalances in university and college courses.

14. There is a need to be able to measure progress against the priorities identified. In 2012, the Royal Society of Edinburgh (RSE) published a comprehensive report, *Tapping All Our Talents* [7], which made strategic recommendations for the recruitment, retention and progression of women in STEM. We are supportive of the STEMEC recommendation that the Scottish Government should report on progress against the *Tapping All Our Talents* recommendations. This would represent an important contribution to informing the STEM strategy.

15. The strategy will also need to consider broader equity issues, including the participation in STEM of ethnic minorities and how geographical barriers to accessing STEM experiences can be addressed.

16. We believe that the *Connection* priority would be strengthened by increasing its breadth as currently it seems to be predominantly focussed on employment needs. This would be an opportunity to make clear the connections within and across STEM disciplines. It would also be an ideal point to highlight the value of interdisciplinary learning (IDL) and higher order skills, which are valued by employers. As the Government is aware, the LSG and the STEMEC have been engaged in a national programme which has sought to improve understanding, articulation and exemplification of IDL in school education. We would be pleased to work with the Government in strengthening the place of IDL within the strategy.

5 *Primary Science Survey Report;* Wellcome Trust; December 2011

6 Science and the Parliament, organised by the Royal Society of Chemistry and supported by a wide range of partners, is an annual gathering of the STEM community in Scotland to discuss key policy themes http://www.rsc.org/events/detail/23502/science-and-the-parliament-2016

7 *Tapping All Our Talents*; A strategy for Scotland; RSE; April 2012
https://www.rse.org.uk/wp-content/uploads/2016/10/tapping_talents.pdf

17. While we do not disagree with the selection of **Inspiration**, perhaps of greater priority is the need to ensure that young people perceive STEM as being for "people like me". ASPIRES research[8] from King's College London shows that while most young people of primary school age report liking school science, very few aspire to become a scientist. The research found that an influential factor is the amount of 'science capital' a family has. Learners with low science capital who do not express STEM-related aspirations at age 10 are unlikely to develop them by the age of 14. This work also demonstrates the need to promote the message that STEM enables young people to keep their career options open and provides transferable skills that are useful for a wide range of careers extending beyond the STEM areas. ASPIRES research is continuing to explore how young people's 'science capital' can be enhanced in schools and more informal learning contexts. We strongly recommend that the Scottish Government, its agencies and partners should monitor these research-based developments.

18. A key element of enthusing learners in STEM and supporting teaching and learning is experimentation and practical work. However, this does not seem to be explicitly recognised in the strategy. We hope this will be rectified in the next iteration.

Question 3: |
Are the success criteria right?

19. Identification of appropriate and measurable criteria for assessing progress against outcomes will be central to realising the strategy. This part of the draft strategy requires extensive work as currently the five outcomes are so broad as to make them unmeasurable. While we recognise that not everything which is considered important can be measured, there is a clear need to be able to assess progress. The high level outcomes need to be broken down into more specific and measureable components.

20. While this is not an exhaustive list and our suggestions will inevitably require further development, we hope they provide a sense of the kind of indicators which will need to be considered: *The proportion of time allocated to STEM during the Broad General Phase of Curriculum for Excellence (CfE); The number (and characteristics) of students presenting for STEM courses and qualifications at school, college and university; achievement levels in STEM qualifications; Schools' participation in STEM Ambassador and Young Engineers and Science Clubs' Programmes; Enrolment figures for Modern Apprenticeships in key STEM sectors; STEM teacher numbers; Primary teachers' STEM qualifications; and Teachers (primary and secondary) participation in STEM-related Professional Update, including the Scottish Schools Education Research Centre's (SSERC) classroom-focussed professional learning.*

21. As well as identifying appropriate criteria, baseline data will need to be collected so that progress can be objectively assessed. While there is reference to the need to gather baseline data in the draft *National STEM Improvement Framework* which is annexed in the strategy, it provides no indication as to what this data will comprise, how it is to be collected and by whom. As an example, it seems clear to us that improved central data on teacher shortages and vacancies are required in order to be able to better match STEM teacher supply and demand. The Government should consider revisiting its decision in 2010 to discontinue its annual report on teacher vacancy statistics.

22. The LSG would be pleased to continue its engagement with the Government as it seeks to identify and develop key performance indicators. It will be important that the Government consults widely on its proposals in this area. It might consider organising a number of focussed roundtable discussions bringing together a range of perspectives to discuss the criteria to be used for assessing progress and the associated data requirements.

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8   ASPIRES: Young People's Science and Career Aspirations, age 10-14; King's College London
     http://www.kcl.ac.uk/sspp/departments/education/research/ASPIRES/ASPIRES-final-report-December-2013.pdf

Question 4: **Do you think the scope of the Strategy is right?**

23. The scope of the strategy is all-encompassing. This has the benefit of enabling a holistic, system-wide approach. We note that it does seek to place an emphasis on children, young people and their families, which we would support as being key to improving participation in STEM. This should include a 'whole school' approach so that responsibility for addressing complex challenges, including gender balance in STEM, does not rest solely with the STEM subjects. As we have stressed elsewhere, this reinforces the need for strategic clarity in terms of being able to assess progress against the high-level aspirations, and the processes for bringing about change.

Questions 5 & 6 on the STEM activity and actions already underway across the sectors

24. This section of the document exemplifies many of the key points we have made already, including the recognition that there is no shortage of STEM education activity in Scotland. However, as a means of developing a strategic approach the Scottish Government needs to make clear the decision-making process for determining the current and proposed activity and, crucially, how its effectiveness is to be assessed. There is a need to ensure that actions are underpinned by rigorous and, preferably, independent evaluation. Those programmes and activities which have proven to have positive impact should continue to be funded on a sustainable basis and scaled-up where it is appropriate to do so. While launching new initiatives and developments can be attractive, they can be destabilising and inefficient if they are not underpinned by a sound evidence base. This reinforces the need to ensure strategic coherence across activities.

25. The draft strategy recognises that teacher competence has the greatest effect on student achievement, with the early and primary years being particularly crucial for STEM. We welcome this recognition as we are firmly of the view that continuing effort is needed to build the capacity of the teaching profession at all levels. If we are serious about supporting teachers to develop and improve continuously, this will require sustained funding and support. Time availability, particularly when there is a shortage of teachers in STEM areas and difficulty obtaining supply cover, is likely to be the most important factor in terms of facilitating teacher professional development and collaboration.

26. Science in particular is often somewhat counter intuitive and to teach it effectively teachers need to have an understanding of both the subject knowledge base and pedagogy. *Teaching Scotland's Future*[9] was clear on the need for science and mathematics to feature prominently in initial teacher education programmes for primary teachers. Consideration should be given to the extent to which STEM features within the ITE primary programmes. We recommend that the review[10] of ITE programmes by Education Scotland and the General Teaching Council for Scotland (GTCS) be extended to consider STEM provision within the primary programmes.

27. Education Scotland has reported[11] that a lack of confidence in teaching the sciences remains an issue for many primary teachers. This reinforces the need to provide the current cohort of primary teachers with opportunities to engage in career-long science specific professional learning.

28. The points made here emphasise the need to ensure strategic coherence across Government strategies and frameworks, especially the relationship between the NIF, which prioritises literacy and numeracy, and the key challenges for teacher professional development in STEM. In addition, the *Making Maths Count* report contains a number of its own recommendations and it is important that these be incorporated into the overall STEM strategy.

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9   Teaching Scotland's Future; Report of a review of teacher education in Scotland; Scottish Government; 2010
http://www.gov.scot/resource/doc/337626/0110852.pdf

10 The proposed review of ITE programmes is one of the actions set out in the Scottish Government's Delivery and Improvement Plans for Education.
http://www.gov.scot/Resource/0051/00511513.pdf

11 Education Scotland 3-18 Sciences Report (2013 update)
https://education.gov.scot/improvement/sci14sciencescurriculumimpact

29. The strategy makes clear the need to address the persistent shortage of teachers in STEM subjects, especially in Chemistry, Computing Science, Mathematics and Physics. Successful delivery of the strategy will be reliant on there being a sufficient number of qualified STEM teachers. Teacher professional status and supply are fundamentally linked. High-quality initial teacher education and ongoing subject-specific professional development are key components.

30. The Scottish Government plans to build on the *Inspiring Teachers* recruitment campaign to attract STEM graduates into teaching. We recommend that the evaluation of the initial campaign be made publicly available so that its impact can be fully understood. This will be critical to in informing the new phase of the campaign.

31. The Government has also recently announced 11 new routes[12] to get teachers into the classroom, including for priority STEM subjects. It is our understanding that these remain proposals until such time that they are accredited by the GTCS. We look forward to seeing the details of these developments. While we welcome the commitment to increasing STEM teacher numbers, it will be important that the new routes do not result in a diminution in standards and entry requirements to programmes of ITE, given the extent to which teacher competence influences learner progress. We support the drive towards Masters-level qualifications which are being pursued through the Government's Delivery Plan for Education. Consideration will need to be given to the sustained support, including financial and time that will be required to enable teachers to engage in Masters programmes.

32. Given the need to ensure that all teachers are able to access career-long professional development opportunities, we were somewhat surprised at the lack of reference in the strategy to the invaluable work undertaken by SSERC, particularly as the Scottish Government, along with local authorities, provide its core funding. It is clear that SSERC will continue to play a crucial role in providing STEM professional development and support to primary (particularly its Primary Science Cluster Programme) and to secondary school teachers. We welcome the fact that SSERC programmes are subject to regular and independent evaluation which have demonstrated positive impact[13]. STEMEC indicated that the Government should consider extending SSERC programmes and that there is a need to provide greater financial certainty so that it can plan for sustaining programmes over a longer time period. We support this recommendation.

33. In relation to university-led research in STEM areas, we are surprised that there is no mention of *ScotCHEM* despite all of the other STEM-related research pools being referenced. ScotCHEM works closely with Chemical Sciences Scotland, Scottish Enterprise and a range of employers to provide placement opportunities in industry, enhance graduate training in STEM areas and generally act as a leader in promoting science skills, both through outreach to schools and increasingly via collaboration with industry for skills enhancement. We suspect its omission is an oversight and we look forward to seeing it acknowledged in the next version of the draft strategy.

34. There is no research pooling for the Mathematical Sciences across Scotland, and hence the discipline has not had the opportunity to benefit from this type of investment. Activities to support STEM education in the Mathematical Sciences at all levels does occur in individual universities, but this is on an ad-hoc basis, and lacks the focus that could be achieved – and has been achieved in other areas – through research pooling.

Questions 7 & 8 on the principles for implementation

35. We broadly agree with the principles for implementation as they align with our key comments, notably the need for: criteria against which the strategic outcomes can be assessed; collection of baseline data; and independent evaluation of activity. As we set out in our opening remarks, we are firmly of the view that an implementation plan should be brought forward alongside the strategy. It will also be important that this extends beyond Government and its agencies. Buy-in and ownership will need to be secured from a wide-range of partners. Our earlier suggestion that the Government might organise facilitated discussions to consider the details of how the strategy is to be implemented is relevant here.

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12 Scottish Government Release 30 November 2016 http://news.gov.scot/news/new-routes-into-teaching
13 Reports on SSERC evaluation: http://www.sserc.org.uk/reports

36. While we welcome the fact that the CSA will act as a conduit between the Government and the wider science sector in the delivery of the strategy, this would appear to be a formidable undertaking for one individual. The LSG would certainly wish to play a role here and we would be pleased to meet with the CSA and the Government to discuss how we can contribute. The SSAC would also be well placed to provide a brokerage role.

Questions 9 – 14 relating to the proposed actions to achieve the strategic aims

37. Many of the central points we make in our preceding responses are relevant here. While the document presents an impressive list of proposed actions, careful consideration needs to be given to the criteria used for their selection, how they are to be implemented and how they will be assessed. A number of the actions are quite general which means that while it is difficult to argue against them, they do not provide the level of detail which will be required if they are to improve STEM education. For example, there are several references to 'using data', 'working together', 'taking action', 'funding activity' and 'maximising engagement', but there is little sense as to what these actions will look like in practice. This could, in part, be addressed through the process of establishing an implementation plan to direct delivery of the strategy. In developing the strategy the Government will also need to set out how it will prioritise delivery of the actions as clearly they cannot all be implemented at the same time (particularly at a time of diminishing public resource) and some will need to be afforded greater priority than others. Emphasis will need to be given to the collection of baseline data and evaluation so that the actions can be assessed.

38. We note that Education Scotland will be responsible for leading the delivery of many of the proposed actions. Given that the role and functions of this agency are being examined as part of the School Governance Review it is possible that these could change quite significantly. Consideration will also need to be given to whether Education Scotland has the capacity and resource to take on the proposed actions, particularly as its own staffing resource has contracted in recent times as it has had to re-balance its priorities.

39. We note the plans to re-consider the minimum entry requirements to initial teacher education programmes as part of the GTCS's review of entry requirements which will be undertaken in 2018. The LSG looks forward to engaging in this process. Taking into account the priority to address primary teachers' competence and confidence in STEM, during the last GTCS review we recommended that applicants to Primary ITE programmes should have at least one science qualification at SCQF level 6 (e.g. a Higher or equivalent) either on entry to the programme or by completion. STEMEC makes a similar recommendation for phasing this in. This would not negate the need to ensure that the current cohort of primary teachers is able to access high-quality CPD in science and pedagogy.

40. We recognise that bursaries of up to £30K have been used in England & Wales in order to attract STEM graduates in to teaching in shortage subjects including Physics, Chemistry and Computing. The National Audit Office has recommended that these bursary schemes should be fully evaluated to assess their effectiveness. We would encourage the Scottish Government to monitor the output from the evaluation process with a view to informing STEM teacher recruitment and retention policy in Scotland. The Government could also gather data on the extent to which Scottish STEM graduates are taking-up the English and Welsh bursaries so as to ensure that potential STEM teachers in Scotland are not being lost.

41.   The draft strategy recognises that parental engagement and support is crucial to encouraging young people's confidence and aspirations in STEM. A key issue relates to how to reach those parents who are currently less engaged in their children's learning. The ASPIRES 2 longitudinal project[14], to which we have already referred, is seeking to understand the changing influences of the family, school, careers education and social identities and inequalities on young people's science and career aspirations. The findings emphasise the need to ensure that careers advice, which should be available as early as possible, reaches all students, but especially those most in need of it, in order to address equity and equality issues. We are clear that gender stereotyping needs to be tackled across the whole school environment, as it spans much more than just the issue of encouraging more girls in to STEM[15].

Question 15: |
Tell us what you think about the STEM Improvement Framework

42.   We welcome much of the content of the draft STEM Improvement Framework. Our main comment is that the Government needs to make clear the relationship between the STEM Improvement Framework and the STEM strategy. As it stands, this improvement framework could be regarded as an alternative STEM strategy. The comments we have made on the draft strategy in relation to how it is to be implemented and how progress is to be assessed are also applicable to the improvement framework.

Question 16: |
Tell us what you think of our proposal for developing a model of collaboration between schools, colleges, universities and employers

43.   Colleges, universities and employers currently engage with schools in a wide variety of ways in support of STEM education and training.

There is clearly a lot of goodwill for collaborative activity. Ongoing priorities on widening access to university and the agenda set by *Developing Scotland's Young Workforce* (DSYW), which has a focus on STEM, will ensure that universities, colleges and employers continue to work in partnership with schools. It is our expectation that DSYW will increasingly influence school education, especially in the senior phase of secondary schooling. Consideration should be given to whether there is way in which the range of activity and engagement could be mapped to support a better understanding of what is available and where, and to identify duplication and/or gaps in provision and access. We recognise that this will be challenging since these partnerships could be based upon individual and local relationships. This is also an issue which the LSG can consider in relation to the programmes and activities supported by its member organisations.

44.   While there is a variation of views on the merits of the Government's school governance proposals, there is growing recognition of the importance of supporting cluster working, in and across schools, and extending to school engagement and partnerships with colleges, universities and employers. As well as helping provide for more effective and informed transitions (e.g. primary to secondary school), clusters can facilitate teacher professional dialogue and development in STEM, including the sharing of innovative teaching approaches and resources. Potentially, clusters could be an effective means of enabling schools to pool resources, including teachers, particularly in shortage STEM areas. The recent announcement from the Government relating to the development of teachers who are able to work in both primary and secondary schools is very interesting in this regard.

45.   We believe that further encouragement of school clusters should be based on a bottom-up approach, led by the schools and the local communities themselves. Clusters should not be mandated by centrally-driven policy as contrived collegiality is unlikely to be successful.

14   ASPIRES 2; King's College London http://www.kcl.ac.uk/sspp/departments/education/research/ASPIRES/Index.aspx

15   For example, the Institute of Physics has published several reports investigating gender imbalance and on issues around equality of education.
      See http://www.iop.org/education/teacher/support/girls_physics/reports-and-research/page_63816.html

46. Collaboration is a central and recurring theme of the STEMEC report, including its encouragement for the provision of campus-based 'hub' facilities to support STEM education and professional development based on the LUMA centre model in Finland. These are based in universities, but rely on partnerships with local authorities, schools, industry and others. We are pleased that this model is referenced in the draft strategy and we encourage the Government to consider whether there is scope to develop a similar collaborative approach in Scotland.

Question 17: Tell us what you think of our proposals for a Scottish STEM ambassador network

47. The proposal is that a Scottish STEM ambassador network will be established in addition to the current UK STEM ambassador programme which operates in Scotland. The Scottish Government needs to make clear what value will be added by the proposed network as currently there is little detail about what is planned. In so doing, the Government should consider the impact of the STEM ambassador programme[16]. Without strategic clarity we fear that the proposed arrangements could lead to confusion for current and future users of the ambassador programme(s). We are also conscious of the need to ensure efficient use of limited resources so it will be important to make sure that any new Scottish network does not unnecessarily duplicate the existing programme.

48. The ambassador network aspirations should also be considered in parallel with those of the Young Engineers and Science Clubs, which already reach 82% of secondary schools and 44% of primary schools in Scotland. Their aim is to be in all Scottish secondary schools by 2018 and all primary schools by 2022.
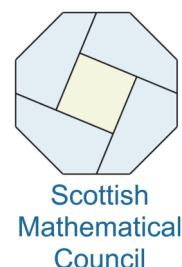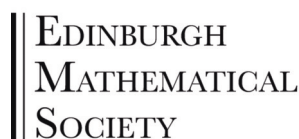
Question 19: Tell us about what you are doing in your organisation, establishment or community that supports the aims and priorities of this Strategy

49. The LSG will be very pleased to continue to engage with the Government and other partners on the development of the strategy. The learned societies and professional associations represented on the LSG are active in a wide range of areas falling within the scope of the strategy, especially (but not exclusively) in supporting learning and teaching of STEM in schools. While individually active, LSG organisations are able to use the LSG and other fora as a means of sharing information and coordinating activity where it is appropriate to do so. Prominent activities undertaken by LSG organisations in support of the aims and priorities identified in the strategy include: free access to high-quality STEM resources and teaching materials; accredited teacher continuing professional development in STEM; publishing journals for teachers, supporting STEM teacher networks in Scotland; facilitating collaboration through our support for STEM network coordinators; providing careers advice; promoting STEM teaching as a career to undergraduates; joint programmes to challenge gender stereotyping in STEM; targeting programmes in schools in areas of deprivation and rural areas; organising major events and workshops in Scotland for STEM teachers; running STEM masterclasses and hands-on activities for young people; and providing expert speakers for schools. A summary of current, relevant education activities undertaken by LSG organisations has been submitted to the Scottish Government in an appendix.

50. More details about our activities are available from the respective LSG member organisation websites. The LSG would be pleased to discuss with the Government how we could further tailor our STEM provision in support of the STEM strategy.

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16 STEM Ambassadors; Making an Impact; December 2016
https://www.stem.org.uk/sites/default/files/pages/downloads/STEM-Ambassadors-impact-report.pdf

Additional Information

For further information about the Learned Societies' Group, contact its Secretariat, William Hardie (whardie@theRSE.org.uk)