

SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS

CONSULTATION ON A STRATEGY FOR EDUCATION & TRAINING



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SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS

CONSULTATION ON A STRATEGY FOR EDUCATION & TRAINING

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FOREWORD BY THE MINISTER FOR FURTHER EDUCATION, HIGHER EDUCATION & SCIENCE



Science, Technology, Engineering and Mathematics (STEM) skills, knowledge and capability unlocks opportunities for all of us to flourish and grow as individuals, as communities and as a country. Every child in Scotland, from the early years onwards, should experience the wonder and excitement of STEM, growing and building the skills and knowledge that they will need in life and in work.

STEM ignites our curiosity about and helps us enjoy and comprehend the natural and physical world around us. STEM skills and knowledge help us to understand, engage with and tackle important issues in society such as climate change and sustainability. STEM helps us be inquiring, productive, creative, inventive and enterprising as individuals and opens up high quality, rewarding, flexible and engaging jobs and careers for us all.

Scotland's economy needs a highly numerate, digitally skilled, capable, creative, entrepreneurial and empowered workforce with a global outlook. There is huge demand for STEM skills, knowledge and capability in Scotland's economy today and this demand is projected to grow. Numeracy and digital skills in particular are increasingly fundamental right across the labour market. The careers and occupations that rely on STEM are diverse and range from healthcare and medicine, animal health, engineering, life sciences, and construction to beauty, design, tourism, retail and financial services.

All children and young people need to develop the skills and confidence to use and understand mathematics, technology and science in their day to day lives as well as in whatever career they choose. We also need to ensure there are opportunities for young people and our current workforce to access the STEM skills and knowledge they need in a developing and fast-changing labour market, and across careers that are becoming increasingly diverse and varied.

Scotland has a strong history and tradition of excellence and innovation in STEM, but we have much to do if we are to meet the demands and challenges of our economy and build the society we want to see now and in the future. This Strategy aims to set out how our education and training offer is contributing to that, and I urge you to respond to this consultation with your views on how we can ensure it continues to deliver on that ambition.

A handwritten signature in black ink, appearing to read 'S Sille'.

Shirley-Anne Somerville MSP

Minister for Further Education, Higher Education & Science

November 2016

RESPONDING TO THIS CONSULTATION

This consultation asks a number of questions about STEM education, training and lifelong learning in Scotland.

Responses should reach us by 31 January 2017. Earlier responses would be welcome.

Responses can either be sent through the Scottish Government's Citizen Space consultation platform by email or by hard copy (a paper copy through the post).

The most straightforward way to respond is on-line through Citizen Space. Details are available in the Consultation Hub on the consultation section of the Scottish Government's website: <https://consult.scotland.gov.uk/stem/a-stem-education-and-training-strategy/>

Citizen Space contains some mandatory fields asking for details of the person or body responding to the consultation and whether the person or body is happy for their response to be published.

Email or hard copy responses must include the Government Respondent Information Form which is provided at the back of this document. This asks for details of the person or body responding to the review and whether the person or body is happy for their response to be published.

Emails can be sent to learningcommunications@gov.scot whilst hard copy responses should be addressed to:

Curriculum Unit, Scottish Government
Area 2B South, Victoria Quay
Edinburgh EH6 6QQ

There is no obligation to respond to all questions. We welcome responses to some or all of the questions.

If you ask for your response not to be published we will regard it as confidential and will treat it accordingly. All respondents should be aware that the Scottish Government is subject to the provisions of the Freedom of Information (Scotland) Act 2002 and would therefore have to consider any request made to it under the Act for information relating to responses made to this consultation.

We will actively seek views from a wide range of people and interest groups during the consultation process. We will be holding focus groups, conversation days and roundtable discussions with as many people as we can and we will reach out to people through social media. You can find more details through the Scottish Government website: <http://www.gov.scot/Topics/Education/Schools/curriculum/STEM/STEMStrategy>

Next steps in the process

Where respondents have given permission for their response to be made public, and after we have checked that they contain no potentially defamatory material, responses will be made available to the public on the Scottish Government Consultation Hub:

<http://consult.scotland.gov.uk/>

How will this be used?

Following the closing date, all responses will be analysed and considered along with other available evidence to help us shape future proposals for STEM education, training and lifelong learning provision in Scotland.

WHAT IS STEM?

Science, Technology, Engineering and Mathematics education and training seeks not only to develop expertise and capability in each individual field but also to develop the ability to work across disciplines and generate new knowledge, ideas and products through inter-disciplinary learning.

- **Science** enables us to develop our interest in, and understanding of, the living, material and physical world and develop the skills of collaboration, research, critical enquiry and experimentation.
- **Technologies** cover a range of fields which involve the application of knowledge and skills to extend human capabilities and to help satisfy human needs and wants, operating at the interface of science and society. This covers business, computing science, chemicals, food, textiles, craft, design, engineering, graphics and applied technologies.
- **Engineering** a specific branch of the technologies, draws on scientific methods and knowledge to address and solve real-world problems.
- All of STEM is underpinned by **Mathematics**, which includes numeracy, and equips us with the skills we need to interpret and analyse information, simplify and solve problems, assess risk and make informed decisions.
- Similarly, **digital skills** play a huge and growing role in society and the economy and enable the other STEM disciplines. Digital skills embrace a spectrum of skills in the use and creation of digital material, from basic digital literacy, through problem solving and computational thinking to the application of more specialist computing science knowledge and skills that are needed in data science, cyber security and coding.

Consultation Question - Definition

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

OUR STRATEGY

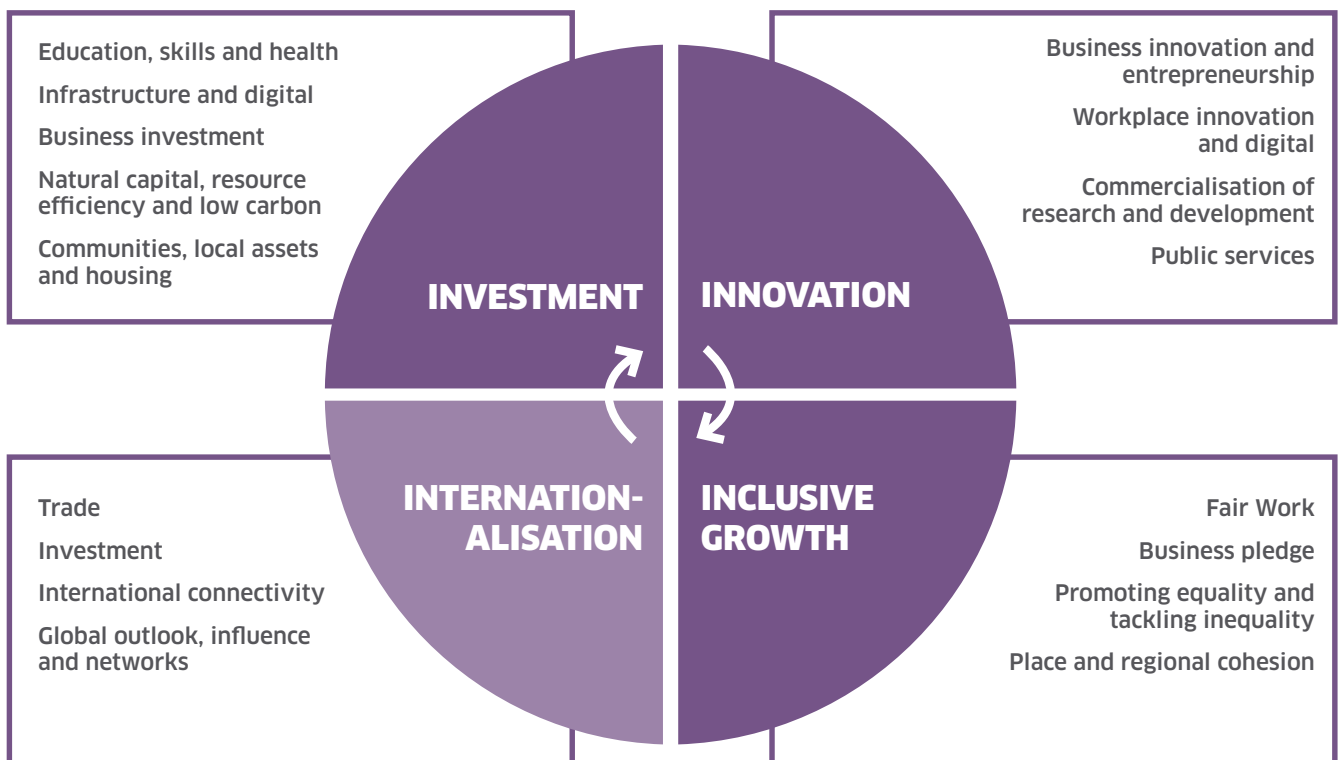
This is a draft strategy for STEM education and training to be owned and delivered jointly across the Scottish Government and its delivery partners, education and lifelong learning providers, employers, and the wider STEM community.

The Strategy has been informed by what we have learned, and continue to learn, from our experience of working to improve STEM education and training provision. It has also been informed by the recommendations made in a number of external studies and reports. We have drawn on in particular the reports from the Science and Engineering Education Advisory Group (SEEAG)¹, the Science, Technology Engineering and Mathematics Education Committee (STEMEC)², the Making Maths Count Group³ and the Royal Society of Edinburgh's Tapping all our Talents report⁴.

Context

A strategic STEM education and training offer has an important role to play in fulfilling the Scottish Government's Purpose for Scotland to be a more successful and fairer country, with opportunities for all to flourish. STEM will contribute to the two goals of our Economic Strategy of **increasing competitiveness** and **tackling inequality** as well as to all of the four areas for action.

The Four Priorities



1 SEEAG Final Report, January 2012 <http://www.gov.scot/Resource/0038/00388616.pdf>

2 STEMEC Final Report, September 2016 <http://www.gov.scot/Topics/Education/Schools/curriculum/STEM/STEMEC/Report/FinalSTEMECReport>

3 Making Maths Count Group Final Report, September 2016 <http://www.gov.scot/Resource/0050/00505348.pdf>

4 Royal Society of Edinburgh Tapping all our Talents report, April 2012 https://www.rse.org.uk/wp-content/uploads/2016/10/tapping_talents.pdf

STEM education and training also has an important role to play in:

- Fulfilling the aspirations for a fair Labour Market⁵ – tackling inequity, increasing competitiveness and fair work.
- Delivering excellence and equity in Scottish Education⁶ – for both raising attainment and closing the attainment gap.
- Achieving our ambitions to prepare young people for the world of work and reduce youth unemployment – through our Developing the Young Workforce (DYW) Programme⁷.
- Realising Scotland’s full potential in a digital world through our aspiration for everyone in Scotland to have the skills and confidence needed to live and work successfully in a technologically-advanced and digitally-inclusive society.

We have much to build on

Scotland has a world-leading reputation in a range of STEM sectors including life sciences, chemical sciences, games technology, engineering, astrophysics and cosmology.

Action is being taken nationally, regionally and locally through the DYW Programme, to ensure young people gain the STEM skills, knowledge and capabilities they need in the workplace. This action is being taken from early learning and childcare onwards, through school education, at college and in Modern Apprenticeships. This work is leading to more joined up pathways for young people from S4 (around age 15) onwards, which prioritise STEM subjects and courses.

There is a wide variety of STEM-related qualifications, courses and awards available to young people at school and college, as well as a range of stimulating and inspiring STEM learning opportunities available from the Science Centres and Festivals. A number of local authorities are taking a systematic approach to improving STEM across all their schools, working closely with colleges and employers, recognising the importance of STEM for raising educational attainment, closing the attainment gap and preparing young people for the world of work.

Careers Information, Advice and Guidance is actively positioning STEM careers as attractive choices for young people.

We have in place a skills planning system to assess national and regional skills needs, working closely with employers, to help them to meet the current and future workforce skills needs. Through this system, Scotland’s colleges and universities are actively increasing the number of STEM-related courses and places they are providing. STEM places are also being prioritised in Modern Apprenticeships with our commitment to expand the number of places available to 30,000 by 2020 focusing on higher level and STEM opportunities. We are supporting colleges to develop STEM strategies. Strong examples of these can be seen in Fife and Edinburgh and in the Glasgow Regional STEM strategy. A number of colleges have secured STEM Assured Status.

5 Scotland’s Labour Market Strategy, published August 2016
<http://www.gov.scot/Resource/0050/00504798.pdf>

6 Delivering Excellence & Equity in Scottish Education – A Delivery Plan for Scotland, June 2016 <http://www.gov.scot/Resource/0050/00502222.pdf>

7 Developing the Young Workforce – Scotland’s Youth Employment Strategy, December 2014 <http://www.gov.scot/Resource/0046/00466386.pdf>

Our Adult Literacies in Scotland Strategy⁸ stresses the need for strong numeracy skills and the Statement of Ambition for Adult Learning in Scotland⁹ emphasises the importance of digital literacy in order to enable adults to participate in digital civic society.

But there are challenges

We think there are opportunities for improvement in the following areas:

- **Addressing inequity.** Achieving greater diversity across STEM courses and training programmes, in particular achieving a better gender balance and addressing the negative impact of social disadvantage, but also addressing the underrepresentation of minority ethnic communities, care leavers and disabled people.
- **Challenging perceptions.** Inspiring, enthusing and improving information and understanding about STEM and the opportunities it can unlock.
- **Developing coherence.** STEM education and training pathways that are clear and co-ordinated across early learning providers, schools, colleges, universities, employers, community learning and development and the voluntary sector, ensuring quality experiences and addressing skills gaps in the economy.
- **Building partnerships.** Harnessing opportunities across sectors within the education, lifelong learning and skills system and with employers, and developing the capacity of education practitioners to deliver inspiring and relevant learning.

AIMS, PRIORITIES, OUTCOMES AND SCOPE

Aims

The Strategy has two key aims:

- To improve levels of STEM enthusiasm, skills, and knowledge in order to raise attainment and aspirations in learning, life and work.
- To encourage uptake of more specialist STEM skills required to gain employment in the growing STEM sectors of the economy, through further study and training.

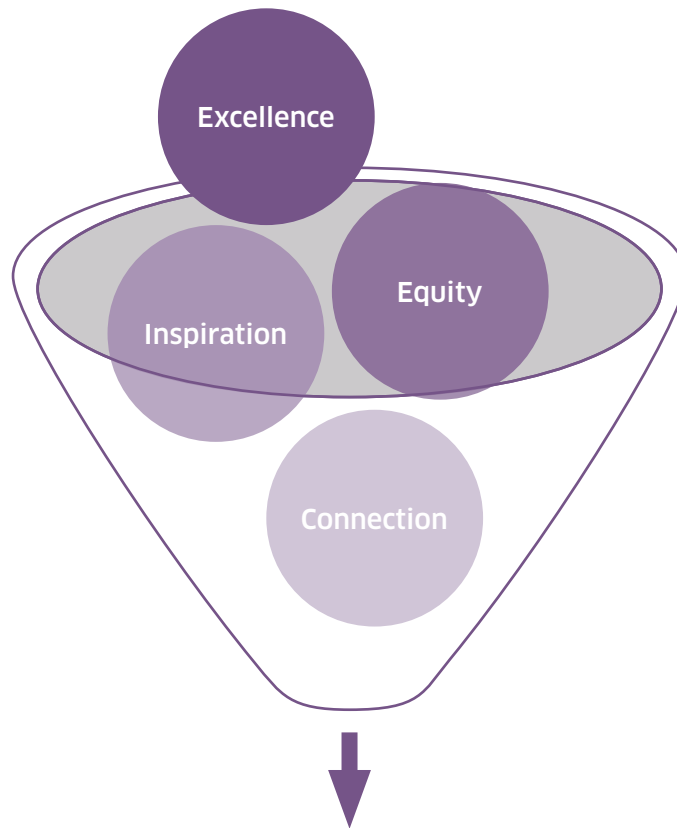
Priorities

To address the challenges identified we have developed four priority themes for the Strategy:

- **Excellence.** Raising the levels of STEM skills and knowledge (including numeracy and digital skills) for all throughout their education, lifelong learning and training experiences.
- **Equity.** Taking action to reduce equity gaps, particularly in relation to deprivation and gender.
- **Inspiration.** Ensuring young people and adults are enthused and inspired to study STEM and to continue their studies to obtain further, more specialised, skills.
- **Connection.** Matching the STEM education and training offer to labour market need both immediate and in the future to support improved productivity and inclusive economic growth.

8 Adult Literacies in Scotland 2020: Strategic Guidance, January 2011
<http://www.gov.scot/Resource/Doc/339854/0112382.pdf>

9 Adult Learning in Scotland - Statement of Ambition, May 2014
<http://www.educationscotland.gov.uk/Images/AdultLearningStatementofAmbition/tcm4-826940.pdf>



Aim 1 Aim 2

To improve levels of STEM enthusiasm, skills and knowledge in order to raise attainment and aspirations in learning, life and work.

To encourage uptake of more specialist STEM skills required to gain employment in the growing STEM sectors of the economy through further study and training.

Consultation Question - Aims and Priorities

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

Outcomes

We will know we have been successful if:

- All children and young people experience relevant and engaging STEM learning across all the STEM disciplines.
- All young people and their families, irrespective of background and circumstance, understand the importance and relevance of STEM to their future success in life and work.
- There is improved gender balance across STEM qualifications and courses at school, college and university, and Modern Apprenticeships in the workplace.
- There are a wide range of STEM pathways through further and higher education and other training that young people and adults can follow, well-matched to labour market need and their needs and aspirations.
- Employers are confident about the STEM skills and capability of their current and future workforce.

Consultation Question – Outcomes

3. Are these success criteria right? If not, tell us what criteria we should use instead.

Scope

A key focus of this Strategy is children and young people as they move from early learning and childcare, through school and on into further and higher education, other training or employment. Within this, particular emphasis is placed on learning in the early years, at primary school and with families. These years are crucial for building enthusiasm and aspiration for STEM, as well as foundational STEM skills and knowledge.

It also extends to programmes of learning, work based learning, training or re-training for adults in community settings, colleges, universities, apprenticeships (including Modern Apprenticeships, Foundation Apprenticeships and Graduate Level Apprenticeships) that enable people to go into, return to or progress within STEM careers later in life, including specifically girls and women.

Consultation Question – Scope

4. Do you think the scope of the Strategy is right? Tell us if you think it should exclude something or include anything else. For example, should it include training and development that employers provide for their workforce?

Current Actions

Annex A at the back of this document provides a comprehensive picture of the context for current STEM activity in Scotland and sets out the actions that are already underway. We anticipate that those actions will have an important part to play in the success of this Strategy, but would welcome your views on whether those actions will continue to have a positive impact and contribution in the context of the proposed aims and priorities of this Strategy.

Consultation Questions – Current Actions

5. Give us your views on whether you think the actions already underway across the sectors on STEM fit well with the Strategy and will contribute positively to it.
6. Tell us about activity currently ongoing – either included in this document or not – that you think could be adapted or stopped and why.

Proposed Actions and Implementation

In implementing and ensuring the success of this Strategy, we are proposing a number of areas in which we could take new or scaled-up action. In shaping and taking these ideas forward we will learn from what works including international best practice. We will seek to build on local regional approaches to improving STEM education, training and lifelong learning that are already in place. We will listen to your views about how the actions proposed here should be developed and implemented, seek help and support to deliver in partnership, and evaluate progress and impact.

Key principles in implementing the Strategy will be to:

- Continue improving our data and understanding of what STEM skills are needed in the labour market, how these are being met by the education and training system, and how this might be improved, including the identification of barriers for particular groups.
- Realise greater efficiency and value for money from publicly-funded programmes through simplifying and streamlining activities and funding.
- Set meaningful key performance indicators for Government and our agencies that drive delivery of the Strategy.

We will consider carefully the most appropriate governance mechanism for overseeing the implementation of the Strategy, including whether existing arrangements are sufficient or if new arrangements need to be developed, in particular to take account of adult skills.

The Chief Scientific Adviser, Professor Sheila Rowan, will act as a conduit between the Scottish Government and the wider science sector in terms of the delivery of the Strategy.

Consultation Questions – Implementation

7. Do you agree with the principles set out for implementation?
8. What else should Government do to ensure a more coherent approach and maximise impact?

PRIORITY THEMES AND ASSOCIATED ACTIONS

Excellence

We propose ensuring **excellence** by raising the levels of STEM skills and knowledge (including numeracy and digital skills) throughout education and training experiences.

The Scottish Government and Education Scotland will:

- Improve the pipeline of STEM teachers into secondary schools, both through building on the success of last year's recruitment campaign to attract STEM graduates into teaching, and through the work that initial teacher education institutions are doing to develop new and innovative routes into teaching.
- Evaluate information on initial teacher education programmes' coverage of numeracy, and other STEM content where available, in order to help us to understand how well prepared student teachers are to teach numeracy and STEM.
- Consider relevant minimum entry requirements to initial teacher education programmes, to feed in to the General Teaching Council Scotland's review of entry requirements.
- Develop a programme of new and enhanced career-long professional learning for practitioners, with a focus on early learning and primary school through strengthened partnerships and collaboration across the education and training system.
- Publish by the end of 2016 draft expected benchmarks for STEM subjects for each level of Curriculum for Excellence. This will allow teachers to ensure their learners are on track.
- Identify, with universities, new opportunities for increasing promotion and uptake of formally accredited SCQF level 11 (often referred to as 'Masters' level learning) courses in STEM subjects and teaching approaches for teachers.
- Deliver the Making Maths Count Report recommendations to improve confidence and fluency in maths for children, young people, their families and adult learners, including working with Learning Link Scotland and other partners to establish a numeracy network with a focus on improving number skills for adults as workers and parents.

The Scottish Government, Education Scotland and Skills Development Scotland will:

- Establish a Digital Schools Programme to test innovative approaches to digital skills development in school clusters.
- Expand Modern Apprenticeships, providing 30,000 new starts each year by 2020, focusing on higher level and STEM opportunities.
- Enable S4, S5 and S6 pupils to undertake high quality, STEM work-based pathways including Foundation Apprenticeships, in partnership with schools and local employers.
- Expand the Making Maths Count recommendation to develop an action plan for improving maths for employment to STEM skills and capability more broadly, working with schools, colleges, employers, and community learning and development.

The Scottish Funding Council will:

- Support colleges to prioritise STEM subjects in developing new senior phase vocational pathways with local authorities in response to the needs of local labour markets.
- Ask college regions from 2017-18 to provide detail of the level and scope of employer engagement within STEM curriculum areas and outline how this engagement impacts on student experience and employability.
- Use the 2017-18 Outcome Agreement process to support colleges and universities in delivering the aims of this Strategy through ensuring coordinated and impactful STEM provision.

Education Scotland and Skills Development Scotland will:

- Support the Energy Skills Partnership to increase the skills development and knowledge of college lecturers to deliver high quality STEM learning at all levels, with a specific focus on improving engineering and energy-related STEM teaching and learning.

Equity

We propose ensuring **equity** by taking action to reduce equity gaps, particularly in relation to deprivation and gender.

The Scottish Government and Education Scotland will:

- Review the impact and effectiveness of numeracy and STEM related activity funded through the Attainment Scotland Fund, in order to help inform future decisions by schools and local authorities on their use of the funding.
- Conduct a STEM-focused review to share what we know and have learned about effective practice to reduce the poverty-related attainment gap.
- Use the data and evidence gathered through the National Improvement Framework to inform policy development on numeracy and target intervention accordingly.
- Extend the Read, Write, Count campaign, that supports parents to continue learning outside of school, into P4-P7 in areas of high deprivation from April 2017.
- Work together with national and local partners to take action to address gender bias in young people's career options, including raising awareness of gender bias with parents, families and teachers so that they can better promote the importance of STEM skills for career options with young people.
- Explore how to generate innovative ways to engage disadvantaged adults in the STEM agenda through community learning and development.

The Scottish Government and Skills Development Scotland will:

- Expand the successful Improving Gender Balance in STEM Project, and share learning through Education Scotland's National Improvement Hub, My World of Work, Careers Information Advice and Guidance advisers and EQUATE Scotland.
- Work with schools and employers to prevent bias on career choice, and encourage more diverse subject choices in order to meet the participation improvement targets set out in the Modern Apprenticeship Equality Action Plan for women, minority ethnic communities, care leavers and disabled people.

The Scottish Government will:

- Fund activity to increase participation of women in STEM careers, including through the recently announced EQUATE Scotland Women Returners initiative.

The Scottish Funding Council will:

- Implement the Gender Action Plan published in August 2016, and ask all institutions to develop their own Gender Action Plans using the Outcome Agreement process to monitor progress on this annually.
- Use the Outcome Agreement process to further widen access to college places for those from the most deprived areas, including for STEM courses, building on the progress made to date.
- Support the Equality Challenge Unit to work with colleges and universities to increase the participation of under-represented equality groups, including in STEM courses.
- Work with universities to look at the feasibility of developing programmes to support school pupils from disadvantaged backgrounds to study STEM subjects in higher education. Similar programmes already exist to support access to high demand professions e.g. the REACH programme. REACH is a national initiative coordinated by universities and schools that supports disadvantaged young people across Scotland to access 'high demand' professions such as dentistry, law and medicine. It achieves this by providing mentoring, intensive support with applications and facilitating work experience opportunities. The programme is also academically rigorous with some universities rewarding completion with adjusted entry grades.

Inspiration

We propose ensuring **inspiration** by enthusing young people and adults to study STEM and to continue their studies to obtain higher order skills.

The Scottish Government and Education Scotland will:

- Support the Science Centres and Festivals to provide children and young people, their families and the wider public, opportunities to engage with and be inspired by STEM.
- Maximise the impact of our science engagement activity to direct support to hard to reach individuals, groups and communities in deprived, rural and remote areas.
- Ensure an enhanced focus on numeracy in the Read, Write, Count campaign.
- Expand the Making Maths Count recommendation for raising the profile, relevance and attractiveness of mathematics to STEM education and employment more broadly.
- Champion STEM through our new Chief Scientific Adviser, Professor Sheila Rowan, in her programme of visits to schools, colleges and universities, and public events. Professor Rowan will help inspire our young people by showing the opportunities offered by a career in STEM, and will engage with people of all ages to explain the relevance of STEM to our lives.
- Use the Career Education Standard (3-18)¹⁰ and Work Placements Standard (senior phase)¹¹ to embed STEM careers awareness within STEM learning, teaching, courses and training programmes. This will be part of the enhanced career long professional learning offer to teachers, recognising the crucial role that teachers have in inspiring and enthusing young people about STEM.

The Scottish Government and Skills Development Scotland will:

- Continue to expand My World of Work Live and our Digital World Marketing campaign to enhance promotion of STEM career opportunities and the range of learning pathways into STEM careers.

10 Career Education Standard, launched September 2015 <http://www.educationscotland.gov.uk/learningandteaching/thecurriculum/dyw/careerseducation/index.asp>

11 Work Placements Standard, launched September 2015 <https://www.educationscotland.gov.uk/learningandteaching/thecurriculum/dyw/workplacements/index.asp>

Connection

We propose ensuring **connection** by matching the STEM education and training offer to labour market need in the short, medium and long term.

The Scottish Government and Education Scotland will:

- Encourage schools to make more effective use of labour market information and their links with employers to design and deliver the STEM curriculum in their schools.
- Work with the DYW Regional Groups to encourage effective STEM employer-school partnerships.
- Disseminate information to community learning and development practitioners around STEM to raise awareness and build into community programmes.

The Scottish Government and Skills Development Scotland will:

- Roll out 'Marketplace', the digital matching platform developed by Skills Development Scotland and the Developing the Young Workforce Edinburgh and Lothian regional group to facilitate better engagement between education and employers.
- Ensure that careers information and guidance delivered in schools highlights the full range of STEM qualifications that are available and highlights the full range of careers that STEM skills and knowledge can open up for young people.
- Develop an enhanced and robust evidence base on the current and future demand for STEM skills in conjunction with industry, and on the supply and outcomes of STEM provision with skills, education and training bodies in order to inform strategic action across Government and its agencies.
- Promote new pathways into STEM careers, particularly in high growth areas such as the digital technologies sector. This will include the continued expansion of the range of STEM pathways that can begin in school through Foundation Apprenticeships.

The Scottish Funding Council and Skills Development Scotland will:

- Support the development and implementation of the Digital Skills Partnership between colleges, universities and digital employers.

Consultation Questions – Proposed Actions

9. Overall, do you think this Strategy is clear and action focused? Do you think that the actions that we propose to take nationally will achieve the aims and intended outcomes?
10. Will this Strategy improve equity of outcomes? If not, tell us what else it should include, in particular for women and girls and other groups of people – disabled people, care leavers and minority ethnic communities.
11. What could schools, colleges, universities, community learning and development, the voluntary sector, science engagement providers and museums do to support the areas for action?
12. What could professional organisations and bodies and third sector organisations do to support the areas for action? This includes, in particular, the General Teaching Council for Scotland, the Standards Council for Community Learning and Development for Scotland, the teaching unions and representatives and the Learned Societies.
13. What more could science centres and festivals do to complement and enhance STEM formal education, to inspire scientists of the future, and to ensure their activities support those of the Scottish Government and its agencies?
14. Should this Strategy identify more actions for particular sectors, for example in relation to workplace and work-based training and development? Please make suggestions on what these actions could be.

Cross-cutting

In addition, the Scottish Government will take the following action that will support all four themes:

- Work with schools to help them improve STEM learning and teaching activity in early learning settings, schools and clusters by connecting with further and higher education providers and employers. We will publish a **National STEM Improvement Framework** for schools that provides a clear and simple approach to achieving this. A draft of the Framework is provided at Annex B.

Consultation Question – STEM Improvement Framework

15. Tell us what you think about this Improvement Framework. How can we best ensure uptake of this Framework in early years learning settings, schools and clusters?

- Develop a **model of collaboration** between schools, colleges, universities and employers to support cluster working, the development of excellent teaching approaches and professional learning, and promotes skills and resource sharing. This will learn from and build on existing centre and hub-type arrangements and international practice, for example the LUMA centres in Finland.

Consultation Question – Collaboration

16. Tell us what you think of our proposal for developing a model of collaboration between schools, colleges, universities and employers. How should we now take this forward?

- Ensure that, by 2020, every school has the opportunity to develop a meaningful and sustainable partnership with the public, private or third sector, to help them improve STEM teaching and learning and inspire young people into STEM careers. We will do this through a **Scottish STEM ambassador network** which will be in addition to the current STEM ambassador programme in Scotland. It would include partnerships with high profile individuals, employers in the private, public and/or third sector and the promotion of models of peer to peer mentoring and support. We will draw on and build on the programmes that are already in place to bring inspirational role models into schools, for example, the Modern Apprenticeships Ambassador programme and local peer-to-peer mentoring initiatives.

Consultation Question – STEM Ambassadors

17. Tell us what you think of our proposals for a Scottish STEM ambassador network. How should we now take that forward?

PARTNERSHIPS

The Strategy is primarily intended to benefit children, young people and their families, adult learners as well as employers through:

- Nursery assistants, teachers and managers,
- Teachers, teaching support staff including technicians and School Leaders,
- Parent Councils and Parent Teacher Associations,
- Educators working in community settings,
- Careers Advisers,
- Colleges staff and leaders,
- University staff and leadership,
- Scotland's Science Centres and Festivals,
- Unions,
- Professional bodies,
- Learned Societies,
- Scottish Council for Voluntary Organisations, and
- Other organisations and third sector organisations who promote STEM or work to improve STEM and gender balance in STEM.

In the delivery of this Strategy, it is intended that the following bodies will drive action forward at national level:

- Scottish Government
- Education Scotland
- Scottish Qualifications Authority
- Scottish Funding Council
- Skills Development Scotland
- Enterprise Agencies
- Education Authorities

We are keen, however, to ensure that we maximise existing and identify new partnerships, in particular with employers, to support and implement this work.

Consultation Questions – Partnerships

18. What other groups, organisations or people need to be involved in delivery of this strategy?
19. Tell us about what you are doing in your organisation, establishment or community that supports the aims and priorities of this Strategy.
20. What could employers do to attract and retain more diverse STEM talent?

ANNEX A – CURRENT STEM CONTEXT AND ACTION ALREADY UNDERWAY

EARLY YEARS AND SCHOOLS

We are committed to an education system that delivers excellence and equity for all. Our [Delivery Plan for Scottish Education](#)¹² sets out the steps that we will take, working with others, to achieve that. We are committed to more support for closing the attainment gap, including through supporting practitioners to network and learn from each other, and support for family learning. We are also committed to ensuring that there is a broad and engaging curriculum in place in schools for children and young people which ensures they make the right progress in learning. We will ensure unnecessary and unintended workload is removed from the classroom. We have launched an [Education Governance Review](#)¹³ to seek views on how teachers, parents and communities can be empowered to have a stronger voice in the running of their schools, and on commitments to establish new educational regions and how collaboration through school clusters can be improved; and on how funding can be made fairer.

The quality of teaching and school leadership are the most important in-school factors in a child's outcomes and, when parents and carers are fully involved in a child's learning and in the life and work of a school, we see better outcomes for children, parents and schools.

The early and primary years are particularly crucial for STEM, both for providing a secure foundation in STEM skills for young people to build on as they go to secondary school and to inspire and develop their enthusiasm to take this further. Engagement and support from parents and families is extremely important to encourage young people's confidence and aspirations in relation to STEM. Building STEM capital within families is crucial if we are to promote positive perceptions of STEM and address issues of gender stereotyping and inequity. Parents and families can also bring in external expertise to broaden children's STEM experiences at school.

Strong partnerships between schools, employers, colleges and universities are also important to build young people's aspirations around STEM, bring learning to life, ensure connections between the curriculum and the world of work, and build awareness of the diverse pathways for young people to follow.

The existing STEM Ambassadors programme already provides a way for schools to bring in STEM experts from a range of fields into schools. Wider learning opportunities, such as the Young Engineers and Science Clubs and coding clubs help young people develop STEM skills and increase their enjoyment of STEM.

Leadership and support for STEM at local level is crucial. Our work with selected school clusters has shown that whole-school and cluster approaches are important in ensuring children and young people progress successfully with their STEM learning and that there is a learning community approach to STEM.

12 Delivery Plan for Scottish Education, June 2016
<http://www.gov.scot/Topics/Education/Schools/DeliveryPlanforScottishEducation>

13 Education Governance Review, launched September 2016
<http://www.gov.scot/Topics/Education/thegovernancereview>

At national level we have and are:

- Providing career long professional learning to teachers through our own investment in the Scottish Schools Education Research Centre and the National Numeracy and Mathematics Hub and working in partnership and collaboration with others to provide support to teachers and schools, for example, through the Wood Foundation's primary science programme, and the Barefoot computing programme in partnership with BT and the British Computing Society.
- Investigating and developing new strategies to tackle gender stereotyping in STEM education through our collaboration with the Institute of Physics.
- Implementing a Digital Learning & Teaching Strategy with a focus on enriching education through the use of technology and actions to develop the skills and confidence of educators, improve access, enhance the curriculum and qualifications and empower leaders.
- Developing the Digital Xtra Fund to provide a coordinated framework for supporting computing related extra-curricular activities. Going forward, the ambition is that Digital Xtra will become an annual fund and will become sustainable by leveraging industry sponsorship. Digital Xtra will supersede our previous approach which has been to support these digital activities on an ad hoc basis. All future funding of this nature will be driven through Digital Xtra.
- Delivering a successful teacher recruitment marketing campaign with a focus on STEM subjects. We are working with the teacher education institutions to develop new and innovative routes into teaching, particularly in the hard to fill subjects, including STEM and in geographical areas that have difficulty recruiting teachers.
- Continuing to liaise with stakeholders to review the STEM qualifications landscape and ensure it continues to be fit for purpose. As part of this SQA will continue to equality impact all qualifications, including to promote gender equality and support the development of new STEM related qualifications when there is a specifically defined need identified.
- Improving Careers Information, Advice and Guidance through Skills Development Scotland's (SDS) recently launched 'Future Me' campaign to support STEM careers information and guidance and provide parents, teachers and pupils with a range of STEM specific careers advice prior to subject choice.

All of this work is underpinned by our National Improvement Framework¹⁴.

14 National Improvement Framework for Scottish Education, January 2016
<http://www.gov.scot/Resource/0049/00491758.pdf>

YOUTH EMPLOYMENT STRATEGY – THE DEVELOPING THE YOUNG WORKFORCE PROGRAMME

Through our Youth Employment Strategy, Developing the Young Workforce, we aim to reduce 2014 levels of youth employment by 40% by 2021.

Developing the Young Workforce is a seven year national programme, which includes steps to enhance work related learning for young people in Scotland, giving them the skills for the current and anticipated jobs market.

To help achieve this, we are working with partners to increase the breadth of opportunity and uptake of senior phase vocational pathways. This includes the roll out and expansion of the new Foundation Apprenticeships.

We have also invested in offering careers advice at an earlier point in school to inform choices. We published the Career Education Standard (3-18), a new Work Placements Standard, and Guidance for School/Employer Partnerships. This will help to enhance the quality, consistency and availability of work related learning. We have also established employer-led Developing the Young Workforce Regional Groups to bring employers and education closer together.

A focus on STEM, as a key area of current and future labour market opportunity, is central to Developing the Young Workforce. This is evident in activity across the school, college and training system.

APPRENTICESHIP OPPORTUNITIES IN STEM OCCUPATIONS

Modern Apprenticeships

Developing the Young Workforce sets out our ambitions to grow, widen and enhance our successful Modern Apprenticeship programme, providing 30,000 new opportunities each year by 2020, focusing on higher skill level and STEM opportunities. Last year, the first step in our move towards this target, we delivered over 25,000 Modern Apprenticeship starts of which around 34% were STEM related. We are working with partners to increase this proportion at the same time as we expand the programme. We are committed to improving gender balance in Modern Apprenticeships and participation by minority ethnic communities, care experienced and disabled people.

A dedicated website (www.apprenticeships.scot) has also been established to enhance and support our apprenticeship offer to employers, young people and their influencers.

Foundation and Graduate Level Apprenticeships

We are also introducing new apprenticeship opportunities through Foundation Apprenticeships and Graduate Level Apprenticeships – with early activity focusing on STEM occupations.

Based upon existing Modern Apprenticeship frameworks, Foundation Apprenticeships have been developed to allow young people to undertake elements of a Modern Apprenticeship while still in school alongside other subject choices like National 5s and Highers. Available to pupils in their senior phase, Foundation Apprenticeships typically last for two years and are set at SCQF level 6 (the same level of learning as a Higher). During their Foundation Apprenticeship young people spend time out of school at college and with local employers, gaining knowledge, skills and experience, and demonstrating competency which is assessed in the workplace. Depending on the Foundation Apprenticeship studied, young people will

be able to gain a range of industry-recognised qualifications comprising units from Scottish Vocational Qualifications (SVQs), National Certificates (NCs) and National Progression Awards (NPAs). Foundation Apprenticeships are already available in Civil Engineering, Engineering, Financial Services, Hardware and System Support and Software Development.

Graduate Level Apprenticeships provide a new way into degree-level study for individuals who are currently employed, or who want to go straight into work. Graduate Level Apprenticeships are being developed as a way that employees can develop higher levels of academic learning and industry accreditation at the same time as allowing employers to develop their workforce with industry-recognised standards designed around the needs of industry. Through this new offer Apprentices can progress to the highest level of professional qualifications with a range of entry and exit points from a Higher National Diploma (SCQF level 8) to a Master's degree (SCQF level 11).

Skills Development Scotland (SDS) has worked with Strathclyde, University of the Highlands and Islands, Robert-Gordon University, the Open University and Forth Valley College/ Herriot-Watt University to develop Graduate Level Apprenticeships in engineering. The first Graduate Level Apprenticeships began in 2016 with an initial focus on Civil Engineering. Similar work will commence for the other sectors, initially including ICT/Digital, and Engineering.

Employer Engagement

In expanding apprenticeships across Scotland it will be vital to work with employers to increase the STEM opportunities. The introduction of the Scottish Apprenticeship Advisory Board will provide direct employer input into the ongoing expansion and improvement of the apprenticeship offer in Scotland including consideration of the recommendation from DYW to ring-fence a proportion of Modern Apprenticeship starts in STEM.

COLLEGES AND UNIVERSITIES

Colleges and universities are primary providers of STEM courses and are already prioritising STEM provision and linking their STEM education and training offer to labour market needs.

Public funding for Colleges and Universities is channelled through the Scottish Funding Council (SFC) and is governed by the SFC's Outcome Agreement (OA) process. This process is intended to support and complement an institution's own strategic ambitions in response to Scottish Government priorities. The OA details the institution's baseline position, current progress and future ambitions against Government priorities, and SFC utilises the OAs to support and evidence institutions prioritisation of STEM.

The College sector has strong foundations to build upon in relation to STEM provision. In 2014-15 there were around a third more Full Time Equivalent (FTE) students on engineering, science and maths courses at colleges compared with 2006-07. This included 1,019 more (+39%) science and maths FTE students and 3,737 more (+33%) FTE engineering students.

In the university sector, the SFC has funded 1200 additional undergraduate places over the 4 year period from 2012-13 to 2015-16 specifically for STEM subjects. We have allocated 342 additional places for undergraduate skills places, primarily for life sciences and energy related courses. Universities have been successful in filling these places and many of the students are offered an opportunity to undertake work experience as part of their studies.

The SFC has developed and is implementing a gender action plan which aims to address gender imbalances in university and college courses.

At national level SFC is taking the following actions through the OA to enhance and support STEM opportunities:

Through the Outcome Agreement process, the Scottish Funding Council asks that colleges:

- Work to ensure young people understand and are encouraged to pursue pathways through school and college learning on to employment. In our discussions with college regions we consider progress in the development of good linkages between schools, colleges and employers to provide these pathways.
- Work with local authorities and schools to map STEM provision in their area and where appropriate, prioritise the development of relevant new vocational pathways in this area. These pathways should focus on labour market need (drawing on information from Skill Investment Plans (SIPs) and Regional Skills Assessments (RSAs) and direct engagement with employers); prioritise STEM subjects if there is an identified skills gap in the region; and be developed in a way that achieves gender balance and supports key equality groups.
- Map STEM pathways in their regions and in identifying practical action that supports the prioritisation of STEM – in order to identify any areas of duplication, gaps or unmet need.
- Report on the volume and proportion of Credits delivered to learners enrolled on STEM courses and set out their aspirations for the future. We ask them to report on the volume and proportion of Credits relating to learners from different protected characteristic groups and care-experienced learners.
- Outline their key ambitions to tackle gender imbalances at a subject level within their Outcome Agreements and to identify and address under-representation from protected characteristic and socio-economic groups.

Through the Outcome Agreement process the Scottish Funding Council asks that Universities:

- Adjust and adapt their curriculum in response to evidence of current and future skills needs of employers and the economy, particularly those of priority sectors (e.g. ICT/digital and low carbon sectors).
- Report on the number and proportion of Scotland-domiciled undergraduate entrants to STEM courses.
- Evidence how the institution meets the needs of current and future skills requirements of employers as outlined in the Sector Skills Investment Plans, other available labour market information, and through their partnerships with employers.
- Detail the level and extent of employer engagement within curriculum areas and outline how this engagement impacts on student experience and employability.

Through the outcome agreement process SFC will have prioritised curriculum alignment and articulation with college STEM HNs supporting and promoting articulation.

SFC funds access to STEM SWAP courses which provide guaranteed progression to year one of any STEM degree course.

SFC also provides significant levels of support for STEM engagement, development and research including:

Research Pools

Continued investment in research pools which are STEM focussed, including SUPA (pooling of physics research and post-graduate education in 8 Scottish universities); The Marine Alliance for Science and Technology for Scotland (MASTS) is a consortium of organisations engaged in marine science; SAGES pools world-leading expertise in geoscience and environmental science from across Scotland's research base, creating a multi-disciplinary alliance at the forefront of earth and environmental research; Scottish Research Partnership in Engineering comprises a collaboration between three regional research partnerships; Scottish Universities Life Sciences Alliance (SULSA) which makes Scottish bio-research more globally competitive by pooling resources from the leading universities in the Life Sciences; Scottish Imaging Network (SINAPSE); SICSA and e-Placement Scotland.

It is widely acknowledged that employers require graduates with good technical ability combined with business awareness and communication skills. It is recognised that the best way to consolidate employability skills is in the workplace. Our funding of e-Placement Scotland is a partnership project in conjunction with Edinburgh Napier University and ScotlandIS (industry trade association) funded by the Scottish Funding Council designed to increase the number of paid placements for computing and IT students studying at Scotland's universities and colleges. SFC's investment in this initiative totals £1,372,000.

Innovation Centres

The Innovation Centre programme, developed in partnership by SFC and the enterprise agencies, was launched to support transformational collaboration between universities and businesses across Scotland's key economic sectors. Many of the sectors represented by the Innovation Centres fall within the STEM subject areas and the skills provision on offer from the Innovation Centre programme has been carefully crafted to support the relevant industry's skills needs. For example, The Data Lab works closely with industry and academia to create a pipeline of talented data scientists, through a portfolio of education programmes such as their MSc programme and through their online learning and continuing professional development. A key area of focus is industrial engagement through workshops and projects with industry and public sector participation to ensure an appropriate fit to the future skills needs of the industry. Another example of raising the levels of STEM skills and knowledge exists in PhD projects currently on offer jointly by the Industrial Biotechnology Innovation Centre (IBioIC) and the Scottish Aquaculture Innovation Centre (SAIC). This provision will benefit two of Scotland's key sectors – aquaculture and industrial biotechnology. These projects will offer doctoral students connections to relevant industry, thus boosting the students' employability whilst also enabling the industry in Scotland to benefit from graduates with relevant skills and experience.

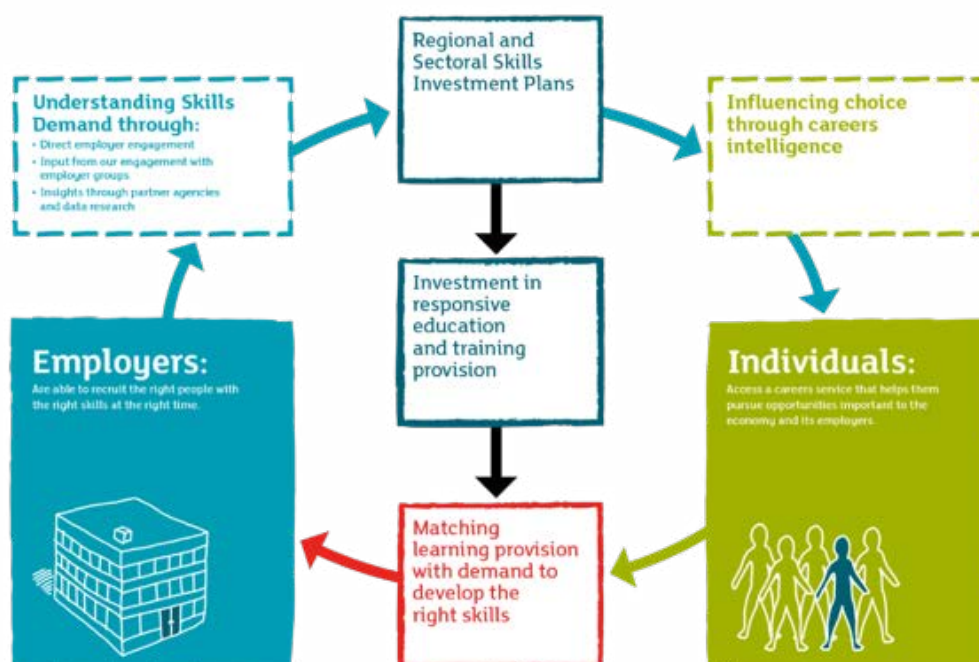
Energy Skills Partnership

SFC and SDS fund the Energy Skills Partnership (ESP) which aims to increase Scotland's capacity to deliver skills and prevent duplication of effort and investment for the energy sector by ensuring capacity, quality and affordability. The ESP vision is of a college sector which works collaboratively to deliver the right skills, in the right place at the right time for the energy sector, maximising Scotland's economic development and the generation of industry capacity for jobs growth. The partnership's scope includes the development and delivery of education and skills provision across identified industrial themes including engineering, renewables, power generation, transmission and distribution, oil and gas, advancing and emerging technologies, energy management and efficiency and construction. The ESP has aligned its workplan with the Engineering and Construction SIPs and has published a STEM framework and provision map with the purpose to help employers and network colleges to be better informed about what colleges offer and where.

MEETING THE STEM SKILLS NEEDS OF EMPLOYERS

Skills Development Scotland works closely with employers, industry bodies and partner agencies to build a comprehensive understanding of skills demand and challenges across key sectors. This is based on the Skills Planning Model which aims to improve the response of the skills system to the needs of industry, and to bring about a progressive alignment of supply and demand. For STEM, this entails enhancing and strengthening the evidence base for both skills demand in a number of STEM sectors (including energy, ICT/digital, engineering, construction, chemical and life sciences) and for STEM occupations in other sectors of economic importance. SDS deploys this understanding of skills demand through its work with schools, further and higher education and other training providers so that its offer is shaped by these demands.

The Skills Planning Model
Making Skills Work for Scotland



Skills Investment Plans

To articulate the skills needs of the current and future workforce, and to outline how these needs will be addressed, SDS works with industry to produce sector specific Skills Investment Plans (SIPs). For STEM sectors, SIPs have been published for the Chemical Sciences, Construction, Energy, Engineering, ICT/Digital and Life Sciences. They describe the skills challenges and opportunities in these STEM sectors and convey the economic and labour market situation, trends in skills and qualification supply and employers' perspectives on the big issues affecting sector growth. SIPs are created through a process of labour market and skills supply research and analysis, industry consultation, and action planning with industry and partners across Scotland's education and skills system.

SIPs are endorsed by the relevant Industry Leadership Group, and submitted to the Skills Committee (a joint committee of SDS and SFC) which makes recommendations on the resource needed to ensure that SIPs can be implemented.

Each SIP has an action plan which details key service improvement measures aimed at supporting the growth and ambition of the sector, and includes actions in relation to:

- Inspiring and preparing young people to engage in the opportunities provided by these STEM sectors;
- Developing pathways to enable more people to enter these STEM sectors with a focus on youth employment;
- Continuing to strengthen and enhance the intelligence on current and future skills needs for these STEM sectors; and
- The plans also outline expected outcomes from these measures, identify responsible stakeholders and partners and set timelines. SIPs are refreshed approximately every three years in order to ensure they continue to reflect the specific needs of the sector.

Regional Skills Assessments

Regional Skills Assessments (RSAs) present a robust picture of the evidence on current and projected skills demand, supply and investment in each region. They are formulated by SDS using 60 different labour market indicators.

SDS collaborated with Scottish Enterprise, Scottish Funding Council and the Scottish Local Authorities Economic Development Group to develop and launch RSAs in 2014. An RSA steering group, comprising these bodies and HIE, is in place to provide oversight, meeting approximately five times a year.

Following feedback from partners, the most recent RSA refresh (2015) comprises 46 RSAs providing comprehensive data at a range of geographical scales:

- Regional Outcome Agreement Areas
- Local Authorities
- City Deal Regions
- Scotland-wide level.

As part of our commitment to innovation and continuous improvement in response to partner feedback, this year the RSAs will be strengthened by the inclusion of bespoke future forecasting analysis. Another development is the inclusion of Participation Measure data, broadening the intelligence on individuals in RSAs.

With their comprehensive capture of local skills evidence, RSAs will help to:

- ensure that services are locally responsive and better targeted;
- support the SFC and regional colleges in negotiating Regional Outcome Agreements for 2017-2020;
- provide a framework for aligning SDS investment in individuals and businesses;
- assist partners in planning their strategic investment in skills; and
- highlight gaps in national and regional skills evidence.

Both the SIPs and RSAs will contribute to the strong evidence base needed to shape future actions and activity in STEM. They will support the 'excellence' theme actions to ensure colleges use SIPs and RSAs information to expand STEM courses in their general provision and prioritise STEM subjects in developing new senior phase vocational pathways with local authorities. They will also support the proposed action on developing an enhanced and robust evidence base under the connection theme where SDS will lead on producing a comprehensive evidence base for STEM to inform strategic action.

SCIENCE CENTRES AND FESTIVALS

Scotland is unique in terms of STEM engagement. We are the only part of the UK to provide comprehensive support for science engagement activity through our funding for Scotland's Science Centres and Science Festivals.

STEM engagement plays an important role in empowering people of all ages to make informed decisions and positive behavioural changes in terms of STEM-related issues, for example health and wellbeing or the environment. Our STEM engagement activities support and enhance formal learning; they encourage young people to study STEM subjects at school, college or university; and they raise awareness of STEM-related career opportunities.

Science Centres deliver science engagement experiences in an accessible, imaginative and thought-provoking way and Scotland is fortunate to have four Centres located in each of our major cities:

- Aberdeen Science Centre
- Dundee Science Centre
- Dynamic Earth (Edinburgh)
- Glasgow Science Centre

All our Science Centres take a unique approach to promoting and encouraging engagement with STEM, not just through their fixed exhibits and facilities but also their extensive learning programmes, outreach activities and in-house events programmes, and online resources. These include:

- Learning programmes and activities for nursery, primary and secondary school pupils that complement and support Curriculum for Excellence principles, capacities, experiences and outcomes. Also extra-curricular activities including weekend or holiday science clubs and STEM careers events.
- Teacher career long professional learning (CLPL) – delivering workshops for teachers on a range of STEM issues on an in-house or outreach basis. Online resources for teachers are also available.
- Targeted programmes to engage with ‘harder to reach’ audiences in deprived or rural communities. This involves working with local community groups and other agencies to deliver relevant and accessible STEM-related outreach activities.
- Showcasing Science by working with Scotland’s research community to develop and deliver exhibitions, shows, workshops and ‘Meet the Expert’ events which reflect cutting-edge research and development in STEM in a context which is relevant to learners of all ages.

Science festivals in Scotland range from small community-led events in rural areas to larger events in towns and cities. They deliver a wide range of STEM-related activities from lectures, exhibitions, workshops, live demonstrations, guided tours and panel discussions to cultural events such as plays or musical productions.

Each festival has a distinct local flavour, but all provide stimulating and fun opportunities to explore STEM in informal surroundings, as well as providing support for classroom learning, role models for careers in STEM, and opportunities for researchers and others working in STEM to explain, share and debate their work.

COMMUNITY LEARNING AND DEVELOPMENT

Community learning and development (CLD) is a way of working with individuals and communities to increase their skills, confidence, networks and resources to tackle issues and grasp opportunities.

Community learning and development is delivered by a range of bodies including national organisations, local authorities, and community groups. The focus for this work is derived from understanding the needs of these communities which is guided by the CLD Regulations for Scotland.¹⁵

CLD can make a significant contribution to STEM through:

- improving adult skills levels in numeracy and digital literacy;
- improving employability through inspiring people to develop STEM skills;
- improving young people's understanding of STEM through youth work activities such as outdoor learning, digital media and citizen science;
- improving parental knowledge and understanding of STEM careers through adult education and family learning;
- articulating the science in community led initiatives such as recycling, allotments/ community growing, beach/community clear ups etc.;
- empowering communities, to take control of the issues that matter to them to improve local outcomes, such as engaging in decision making;
- engaging with employers to raise their awareness of STEM skills and to support employees through investing in work based learning; and
- Education Scotland's role in supporting the above is to lead the development and implementation of CLD policy, to build capacity and support improvement and provide public accountability through scrutiny.

Examples of CLD policies that link closely to the STEM aims:

The Adult Learning Statement of Ambition emphasises the importance of developing digital literacy to participate in digital civic society. Exemplification of this in the sector is the Digitally Agile National Principles for CLD¹⁶ aims to ensure that young people, adults and communities are better able to access and use new technologies and social media as part of their individual learning journey and for social action, through the improved knowledge, confidence and competence of CLD practitioners.

The Adult Literacies in Scotland strategy emphasises the importance of improving numeracy capability through the development of number skills in a range of contexts. An example of materials that have been developed to support adult learners in numeracy is the 'Counting on a Greener Scotland' (COGS) pack. The COGS pack was developed by the Workers Educational Association, Education Scotland and Heather Reid, OBE. The pack provides opportunities for learners to develop their knowledge, skills and understanding of numeracy in the contexts of weather, climate change and energy and their impact on everyday lives.

15 The Requirements for Community Learning and Development (Scotland) Regulations 2013 <http://www.educationscotland.gov.uk/communitylearninganddevelopment/about/policy/cldregulations/index.asp>

16 Digitally Agile National Principles for CLD <http://www.digitallyagilecld.org/>

ANNEX B – DRAFT NATIONAL STEM SELF-EVALUATION AND IMPROVEMENT FRAMEWORK

The aim of this framework is to:

1. Increase knowledge, understanding and awareness of STEM
2. Increase learners’ understanding of opportunities for STEM careers
3. Tackle inequity in educational outcomes and promote equality in STEM areas
4. Provide a coherent framework for partnership working in relation to STEM.

Sustained continuous improvement			
	Starting the journey	Building on achievements	High quality outcomes and positive impact
Improvement planning	Staff, learners and other stakeholders are involved fully in development of improvement strategy that looks inwards, outwards and forwards and which sets challenging targets for improvement. Learners are put at the centre of this process.	A further improvement planning cycle is conducted in partnership with staff, learners and other stakeholders using the principles of inward, outward and forward. Learners are put at the centre of this process. STEM has been included in the establishment of the improvement plan.	Improvement planning approaches in relation to STEM are well-embedded in the culture of the establishment are used in an ongoing basis and engage with an increasing number of external partners. Learners are put at the centre of this process and have a strong voice in all developments. STEM is an integral part of the cluster/Learning community improvement plan, including at points of transition.
Measuring performance	Baseline data is gathered to provide an accurate picture of existing provision, engagement and achievements in STEM.	Evidence is gathered and analysed to show improvements against baseline data and targets set by the establishment in the first cycle of improvement.	Evidence is gathered and analysed to show improvements against baseline data and targets set by the establishment in the second cycle of improvement. There is a demonstrable increase in engagement and achievements in STEM.

Sustained continuous improvement (continued...)			
	Starting the journey	Building on achievements	High quality outcomes and positive impact
Leadership	There is a named person identified to coordinate and lead the development of STEM within the establishment.	Leadership for STEM involves more than a single coordinator - management, staff, learners and other stakeholders take on shared leadership roles and collaborate effectively to drive further improvements across the establishment.	Leadership capabilities have been built effectively across the establishment and cluster. There is leadership for STEM at all levels including staff, parents, young people, and external community/business partners.
Staff professional learning	Staff confidence is enhanced through high quality career-long professional learning supporting further improvements in practice to STEM. Staff have had the opportunity to engage with key STEM policies and documentation to build their understanding and confidence.	Staff have ongoing access to a high quality programme of career-long professional learning which supports collaborative and collegiate working. Staff increasingly engage with research in STEM and are encouraged to become enquiring practitioners in line with the GTCS professional standards.	There is a culture of professional learning, innovation and collaborative professional enquiry in the establishment. Staff take responsibility for their own professional learning and practice draws on a wide body of research and practice from other authorities and schools. Staff share practice effectively through local, regional and national practitioner networks. Staff engage with industry and further and higher education establishments to enhance learning and teaching in STEM areas as well as career opportunities in STEM.

Sustained continuous improvement (continued...)	
Learning experiences	<p>Learning in STEM areas is being delivered through an appropriate blend of approaches including through interdisciplinary learning.</p> <p>Real life applications are used to provide relevant and engaging contexts for learning in STEM areas.</p> <p>The principles of curriculum design are being reflected in learning and teaching within STEM and learning for sustainability issues are addressed within STEM subjects.</p>
Skills and careers	<p>Staff emphasise the importance of skills within their learning and teaching and link learning and skills development to STEM careers.</p>
	<p>There is an establishment vision for the learning and teaching of STEM which builds on prior learning and ensures effective progression in learning and skills.</p> <p>Interdisciplinary learning is well-planned and provides exciting contexts for learning in STEM. Learning and teaching is stimulating and innovative and fully engages learners.</p> <p>Learning for Sustainability is embedded within the STEM curriculum. Learning and teaching in STEM is highly innovative and engaging and is supported by a range of external partners.</p>
	<p>Careful planning across the cluster ensures effective progression in learning in STEM areas from 3-18. Transitions are well-planned and supported through the use of exciting STEM contexts.</p> <p>Learners are highly motivated by their learning in STEM, including through well-planned and engaging interdisciplinary learning opportunities. These opportunities enable learners to make connections across STEM subjects and with other curriculum areas.</p> <p>Learning for Sustainability is fully embedded within the STEM curriculum.</p>
	<p>Progression routes into STEM careers are supported through effective partnership working. Collaborative working across the cluster ensures that skills in relation to STEM are being developed in a coherent and progressive way. The skills being developed meet the needs of local partners, industry, further and higher education establishments and/or aspirations of learners.</p> <p>Information about STEM careers and employability skills have been embedded within learning and teaching, as has the development of higher order thinking skills.</p>
	<p>Skills, including higher order thinking skills, are developed in learners in a progressive way through careful planning and collaboration across the establishment.</p> <p>Links are made to employability skills, and awareness of STEM careers.</p>

Sustained continuous improvement (continued...)

<p>Equity, diversity and equality</p>	<p>STEM planning takes account of the needs of different learners and steps have been taken to promote equality in relation to gender and Additional Support Needs issues and to support learners from deprived communities or from different ethnic backgrounds.</p>	<p>Equity, diversity and equality issues are fully addressed through the improvement planning process and evidence is gathered to monitor and track engagement and achievement of individuals and groups of learners in STEM areas.</p>	<p>Innovative approaches have been used to secure continuous improvements in the engagement and achievement of all learners in relation to STEM.</p> <p>The gathering of evidence demonstrates that all learners are being encouraged to achieve at the highest level and key national, local and school performance measures indicate educational outcomes for all learners are improving.</p>
<p>Partnerships</p>	<p>There is an emerging relationship with parents, local employers and STEM organisations to support STEM activities and promote STEM careers.</p> <p>STEM achievements are celebrated.</p>	<p>Learners, parents, partners and the wider school community are involved in the planning of STEM activities.</p> <p>Relationships with a range of employers and STEM partners continues to grow and flourish to undertake increasingly ambitious STEM activities and promote STEM careers.</p> <p>STEM achievements are celebrated.</p>	<p>Engagement with a wide variety of parents, STEM partner organisations, industry and/or further and higher education institutions continues to flourish.</p> <p>External partners provide opportunities for business and vocational links and career related learning.</p> <p>STEM achievements are celebrated.</p>

ANNEX C – Summary of Consultation Questions

Consultation Question – Definition

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

Consultation Question – Aims and Priorities

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

Consultation Question – Outcomes

3. Are these success criteria right? If not, tell us what criteria we should use instead.

Consultation Question – Scope

4. Do you think the scope of the Strategy is right? Tell us if you think it should exclude something or include anything else. For example, should it include training and development that employers provide for their workforce?

Consultation Questions – Current Actions

5. Give us your views on whether you think the actions already underway across the sectors on STEM fit well with the Strategy and will contribute positively to it.
6. Tell us about activity currently ongoing – either included in this document or not – that you think could be adapted or stopped and why.

Consultation Questions – Implementation

7. Do you agree with the principles set out for implementation?
8. What else should Government do to ensure a more coherent approach and maximise impact?

Consultation Questions – Proposed Actions

9. Overall, do you think this Strategy is clear and action focused? Do you think that the actions that we propose to take nationally will achieve the aims and intended outcomes?
10. Will this Strategy improve equity of outcomes? If not, tell us what else it should include, in particular for women and girls and other groups of people – disabled people, care leavers and minority ethnic communities.
11. What could schools, colleges, universities, community learning and development, the voluntary sector, science engagement providers and museums do to support the areas for action?
12. What could professional organisations and bodies and third sector organisations do to support the areas for action? This includes, in particular, the General Teaching Council for Scotland, the CLD Standards Council, the teaching unions and representatives and the Learned Societies.
13. What more could science centres and festivals do to complement and enhance STEM formal education, to inspire scientists of the future, and to ensure their activities support those of the Scottish Government and its agencies?
14. Should this Strategy identify more actions for particular sectors, for example in relation to workplace and work-based training and development? Please make suggestions on what these actions could be.

Consultation Question – STEM Improvement Framework

15. Tell us what you think about this Improvement Framework. How can we best ensure uptake of this Framework in early years learning settings, schools and clusters?

Consultation Question – Collaboration

16. Tell us what you think of our proposal for developing a model of collaboration between schools, colleges, universities and employers. How should we now take this forward?

Consultation Question – STEM Ambassadors

17. Tell us what you think of our proposals for a Scottish STEM ambassador network. How should we now take that forward?

Consultation Questions – Partnerships

18. What other groups, organisations or people need to be involved in delivery of this strategy?
19. Tell us about what you are doing in your organisation, establishment or community that supports the aims and priorities of this Strategy.
20. What could employers do to attract and retain more diverse STEM talent?

Annex D: Respondent Information Form



Science, Technology, Engineering & Mathematics STEM

Consultation on a Strategy for Education & Training RESPONDENT INFORMATION FORM

Please Note this form **must** be completed and returned with your response.

Are you responding as an individual or an organisation?

- Individual
 Organisation

Full name or organisation's name

Phone number

Address

Postcode

Email

The Scottish Government would like your permission to publish your consultation response. Please indicate your publishing preference:

- Publish response with name
 Publish response only (anonymous) – Individuals only
 Do not publish response

We will share your response internally with other Scottish Government policy teams who may be addressing the issues you discuss. They may wish to contact you again in the future, but we require your permission to do so. Are you content for Scottish Government to contact you again in relation to this consultation exercise?

- Yes
 No



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