

SCIENCE TECHNOLOGY ENGINEERING MATHEMATICS

Education and Training
Strategy for Scotland

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Ministerial Foreword

In setting out the bold and ambitious programme for this Government last month, the First Minister focused on the actions we will take to ensure we have a country that is properly equipped for the next decade and beyond, where we aspire to be the inventor and manufacturer of the innovations that will shape the future. In a time of unprecedented global change, our Programme for Government emphasises the importance of finding and seizing the opportunities and harnessing the forces of change that will allow us to shape our destiny and ensure an inclusive, fair, prosperous and innovative Scotland that looks to and embraces the future.

In realising this, it is critical that Scotland recognises the value of, and achieves its full potential in science, technology, engineering and mathematics (STEM). The Scottish Government is committed to ensuring we have a highly educated and skilled population equipped with the STEM skills, knowledge and capability required to adapt and thrive in the fast-paced changing world and economy around us. We have a rich history of expertise, innovation and achievement in STEM that has seen Scotland contribute so much to the world. As we look to the future, it is imperative that we maximise the opportunities presented in our country's innovative spirit. We must continue to welcome and embrace innovation but, moreover, we must strive to lead that innovation in the world. It is through fostering such ambition, and by ensuring the conditions for it to flourish, that Scotland will rise to challenges and seize the opportunities that will stimulate our economy and build the society we want now and in the future.

This strategy sets out our vision of a Scotland where everyone is encouraged and supported to develop their STEM capability throughout their lives, enabling them to be inquiring, productive and innovative, both in order to grow STEM literacy in society and to drive inclusive economic growth. Focusing on key themes of excellence, equity, inspiration and connection, it is designed to drive improvement in relation to STEM and ensure co-ordinated and focused action right across the education, training and skills landscape in Scotland. I am confident that with collective determination in the pursuit of this vision and through taking the actions set out this strategy we can unlock the opportunities for all of Scotland to flourish and thrive.

Shirley-Anne Somerville MSP

Minister for Further Education,
Higher Education and Science

October 2017

2 Foreword from the Chief Scientific Adviser



Science and innovation are embedded in Scotland's heritage and culture. They will play an ever-increasing role in Scotland's future within the global economy. At all levels, education and training in science, technology, engineering and mathematics (STEM) will open doors to a range of career opportunities, and not exclusively those considered a 'STEM career'. At the same time, wider public engagement with STEM, for all ages, can help increase confidence and strengthen STEM-related life skills and STEM literacy. As Scotland's Chief Scientific Adviser I recognise the value of combining the economic and broader social aspects of STEM education and training within this strategy.

For the last six months I have also co-chaired the short-life Expert Reference Group for the STEM Strategy with Professor Iain Hunter. I would therefore like to place on record my thanks to Iain and to colleagues from a range of sectors who made their time freely available to the Group¹. Each meeting involved positive and constructive discussion, reflecting Group members' determination to see a STEM strategy that supports our next generation of scientists as well as encouraging people of all ages to engage more fully with STEM.

I know that the wider science base in Scotland will take a keen interest in the delivery of this strategy, and I hope that anyone with an interest in this important area will play their part in supporting STEM education and training, for Scotland's future.

Professor Sheila Rowan MBE
Chief Scientific Adviser for Scotland

¹ STEM Strategy Reference Group membership

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Introduction

Scotland rightly takes pride in our history and culture of expertise, innovation and achievement in Science, Technology, Engineering and Mathematics (STEM) and in a legacy which is not confined to the past but which thrives around us.

STEM is an integral part of our future economic and social development. Change is happening all around us and the pace of that change in the workplace, the economy and our everyday lives is relentless. It is driven largely by developments in STEM and, in particular, technology. We know that STEM-related sectors of the economy have been growing faster than Scotland's economy as a whole and this trend is set to continue. In areas such as low carbon and digital technology we need to be equipped to be at the forefront of innovation, and create the right environment for further business investment. To realise this future of opportunity for Scotland to have an innovative, growing economy, we must support the development of a skilled and adaptable workforce that can take advantage of the growing number and evolving range of STEM jobs.

Developing our wider STEM knowledge and literacy is also important to us all as active citizens within the communities in which we live. It helps us to understand the increasingly connected world we live in. It helps us with the complex questions we face, from mitigating climate change to dealing with the impact of an ageing population and it gives us the tools and knowledge to make informed lifestyle choices on issues that may affect us as individuals. Above all, STEM ignites our curiosity and helps us enjoy and understand the natural and physical world around us, enriching our lives.

Education, training and lifelong learning have a key role to play in responding to these economic and societal imperatives by building a strong base of STEM skills and knowledge for everyone and by enthusing and encouraging people to develop more specialised STEM skills and capabilities.

However, for that response to be effective, there are a number of challenges we need to address:

- We need to ensure children, young people and adults are encouraged to develop an interest in, and enthusiasm for, STEM that is reinforced throughout their lives.
- We need to ensure our education system has the right number of practitioners, including teachers, with the appropriate STEM capability, delivering excellent learning and teaching.
- We need to ensure that our education and training system is equipping people with the skills that employers need and that it has the flexibility to respond to the inevitable changes in labour market demand.
- We need to tackle the gender imbalances and other inequities that exist across STEM education and training including in relation to race, disability, deprivation and geography. These are unfair and undermine our ability to deliver inclusive economic growth in Scotland.

There also needs to be more joined-up action within and between the different sectors that make up the whole system of STEM education and training. This includes the sharing of resources and expertise between practitioners so that they can learn from one another. It also includes working together so that there are clear and co-ordinated STEM education and training pathways for people to follow from the early years and on into school, work, college or university.

The strategy sets out the actions for the education and training system, the science engagement sector, and for Community Learning and Development (CLD) which will help address these issues over the next five years. Collaboration and strong partnership working by all those with an interest will be critical if we are able to deliver fully on our ambitions.



What is STEM?

STEM stands for Science, Technology, Engineering and Mathematics. We include numeracy and digital skills within our definition of STEM. Both of these are vital to enable everyone to participate successfully in society as well as across all jobs, careers and occupations. STEM education and training seeks not only to develop expertise and capability in each individual field but also to develop the ability and skills to work across disciplines through interdisciplinary learning. STEM education and training helps us acquire the following skills and capabilities:

- growing our understanding and appreciation of the natural and physical world and the broader universe around us;
- interpreting and analysing data and information;
- research and critical enquiry – to develop and test ideas;
- problem solving and risk assessment;
- experimentation, exploration and discovery of new knowledge, ideas and products;
- collaboration and working across fields and disciplines; and
- creativity and innovation – to develop new products and approaches;

All of these are increasingly important to success in a changing and technologically-driven world. They are also important for helping us to develop as active citizens, making informed decisions for ourselves and for society.

We recognise, in particular, the importance of creativity and innovation for economic growth and the strong synergies that exist between STEM and creativity.

Annex A sets out details of what we understand by the terms Science, Technology, Engineering, and Mathematics.



Case Study

Building STEM Capital – Dundee Science Centre

What is 'STEM capital' and why is it important?

'STEM capital' is the concept that a wide range of knowledge, experiences, attitudes, behaviours and practices will influence people in a range of different ways. It helps shed light on why particular social groups remain underrepresented and why many young people do not see science careers as being 'for me'.

Key components of 'STEM capital' includes participation in out-of-school science learning contexts, for example how often a young person participates in informal science learning contexts, such as science museums, science clubs and fairs, the extent to which a young person's family have science-related skills, qualifications, jobs and interests, and the people a young person knows in their family, friends, peer, and community circles who work in science-related roles.

'CSI CS Why CS How' is a collaborative, community-led learning experience. It directly engaged with adults from rural or socially and economically-deprived areas of Dundee, Fife, Perth and Glasgow. The project aims to develop their skills, knowledge, confidence, family engagement and team working, as well as creating an increased awareness and pride in scientific research and developments taking place in their local area. It also helped to build STEM capital by demonstrating the message that STEM subjects are relevant and for everyone.

The project was led by Dundee Science Centre and the Centre for Anatomy and Human Identification at the University of Dundee with the support of Writing Practice and Study at the University. The case-based six-week learning experience was themed around a murder mystery scenario and challenged participants to use a range of skills to gather and evaluate evidence in order to solve the mystery. It culminated in a mock court case to which the participants also brought their families.

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Our Approach

This strategy has been informed by a formal consultation process², by our short-life Expert Reference Group, a range of recent reports into STEM education, including the STEMEC report,³ and through discussion and debate across a wide range of events, meetings and forums. We are very grateful to all those that took part in the process.

Our short-life Expert Reference Group was co-chaired by Professor Sheila Rowan, the Chief Scientific Adviser for Scotland, and Professor Iain Hunter of the University of Strathclyde and the Scottish Science Advisory Council. The Expert Group provided opportunities for dialogue with stakeholders and the wider sector, as well as acting as a source of valuable challenge as the strategy was developed.

Going forward, the Scottish Government's network of Chief Scientific Advisers will support the aims of the strategy by promoting the use of science and science advice in policymaking, as well as championing STEM careers, particularly those within government.

A STEM data study⁴ was also commissioned to support the strategy's development, and is being published alongside this document.

We recognise that the different sectors employing those with STEM skills have different challenges and issues, with some, such as the digital and engineering sectors, facing particular recruitment challenges and skills gaps and shortages. This strategy is concerned with enabling everyone to develop the STEM skills that they need for success in life and that they are enthused and encouraged

to pursue jobs and careers in STEM. Other plans and programmes, including the Skills Investment Plans, are designed to tackle the specific skills and recruitment challenges faced by particular sectors.

This strategy links to and builds on a number of related Scottish Government strategies and programmes, including *Scotland's Labour Market Strategy*, *Realising Scotland's Potential in a Digital World* and the *Enterprise and Skills Review*. In particular, the strategy supports the implementation of the specific STEM recommendations of the *Developing the Young Workforce* (DYW) programme, Scotland's youth employment strategy, through which the Scottish Government aims to create an excellent, work-relevant education offer to young people in Scotland, giving them the skills for the current and anticipated jobs market. This includes creating new vocational learning options; enabling young people to learn in a range of settings in their senior phase of school; embedding employer engagement in education; offering careers advice at an earlier point in school; and introducing new standards for careers guidance and work experience.

This strategy also complemented, and its recommendations will be supported by, the Scottish Government's current review of the 15-24 Learner Journey which is considering how we can improve the efficiency and effectiveness of learners' experiences from the Senior Phase and through tertiary education. That review covers careers information, advice and guidance; applications; provision, transition and progression; and funding⁵.

² <http://www.gov.scot/Publications/2017/03/7109>

³ <https://beta.gov.scot/publications/stemec-report-2016/>

⁴ <http://www.gov.scot/isbn/9781788513616>

⁵ <http://www.gov.scot/Topics/Education/post16reform/post16reform>

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The 15-24 Learner Journey review will present policy options to further the aims of this strategy. As part of the review, we are gathering evidence and views on the approach to and impact of careers information, advice and guidance in colleges and universities, and examining how we could further enhance the digital services that support access and applications. We will also put forward ideas for improving the alignment of school, college, training and university provision, in order to better meet the needs of learners and the economy. As part of this, a key objective will be aligning further and higher education STEM qualifications to the needs and demands of the economy, giving graduates access to a range of valuable and exciting career opportunities.

The strategy also supports the Government's ambition to make Scotland the best place in the world to grow up, through improving the education and life chances of our young people. We are determined to give all our children the best start in life through our *Getting It Right for Every Child* approach and we will also continue with our actions to close the attainment gap and improve attainment for all. To achieve this, we have embarked on a period of reform in our education system. A package of reforms was announced in June 2017 in the Scottish Government report *Education Governance: Next Steps*. In addition, a *Blueprint for 2020: The Expansion of Early Learning and Childcare in Scotland* sets out our vision – almost doubling the entitlement to free early learning and childcare to 1140 hours per year by 2020 for all three and four year olds and eligible two year olds. These major reforms offer an exciting opportunity to embed the aims of this STEM strategy in Scotland's education system.

Supporting and encouraging the development of the STEM skills and capability for the current workforce is also important as we foster a modern, inclusive and innovative Scottish economy. This includes a focus on sectors such as advanced manufacturing and digital. Whilst this strategy does not consider in-work STEM skills development in detail, we will continue to work with industry to develop approaches that enable current as well as future employees to build their STEM skills.

The *Enterprise and Skills Review: Report on Phase 2* contained a wide range of measures to support business, and ensure young people have access to the right skills to create growth across the Scottish economy.

The need for greater skills alignment is a key element within the report, supported by the joint development of a skills planning and provision model by Scotland's skills agencies. This will be an important means through which a range of partners can work together to ensure a coherent and connected STEM skills pipeline, which aligns both STEM education and the STEM training offer with labour market need both now and in the future to support improved productivity and inclusive economic growth.

Alongside this, the Scottish Funding Council (SFC) will continue to develop, improve and intensify the use of Outcome Agreements with institutions to achieve our desired outcomes for learners and skills development. Through this process, the SFC will promote the uptake and benefit of STEM learning in Scotland's colleges and universities. The SFC will also encourage institutions in both sectors to collaborate across the learning system to support STEM education in early years and schools through engagement with industry and an inspiring offer of learning activity.

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Vision, Aims and Outcomes

Our vision is of a Scotland where everyone is encouraged and supported to develop their STEM skills throughout their lives, enabling them to be inquiring, productive and innovative, in order to grow STEM literacy in society and drive inclusive economic growth.

To deliver this vision, everyone needs to have an opportunity to develop the STEM skills and the capabilities they need for life and across all jobs and careers. There is also a need for more people to develop the more specialist STEM skills required to gain employment in the growing STEM sectors of the economy. **This strategy has four key aims:**

- to build the capacity of the education and training system to deliver **excellent** STEM learning so that employers have access to the workforce they need;
- to close **equity** gaps in participation and attainment in STEM so that everyone has the opportunity to fulfil their potential and contribute to Scotland's economic prosperity;
- to **inspire** children, young people and adults to study STEM and to continue their studies to obtain more specialist skills; and
- to **connect** the STEM education and training offer with labour market need – both now and in the future – to support improved productivity and inclusive economic growth.

The following chapters set out the actions that will be taken across the education, training and skills landscape to deliver **Excellence, Equity, Inspiration** and **Connection** in STEM education and training. The timeframe over which these actions will be taken forward is five years, during the period 2017-2022.

In taking the actions set out in this strategy under the themes of excellence, equity, inspiration and connection, **we will work to the following long-term outcomes in pursuit of the vision of a country where everyone develops their STEM capability.**

1. All learners experience relevant and engaging STEM learning, in both formal and informal learning settings, which equip them with skills and capability to be scientifically, technologically and mathematically literate citizens, fully involved in our society as it becomes increasingly reliant on science and technology, and informed and empowered to take decisions about their lives and society as a whole.
2. There is equality of access, opportunity and outcomes in STEM learning and STEM experiences for everyone, regardless of gender, background or circumstance or geography.
3. People are well equipped to undertake job roles which require STEM knowledge and skills, including the flexibility to move and diversify between roles, jobs and careers to keep pace with scientific and technological change. Employers are confident about the STEM skills, capability, and capacity of the current and future workforce.
4. Scotland has a STEM workforce, leadership and research base which supports economic growth, innovation, creativity and increased productivity and which continues to contribute to scientific and technological innovation.

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As a result of the actions of this strategy, by 2022 we expect to see:

- increases in the proportion of people undertaking STEM-related learning, engagement, study and training across all sectors including in school-level qualifications and awards, and participation in apprenticeship programmes **(Excellence and Inspiration)**;
- increased practitioner confidence in STEM learning in the early years, primary years and in CLD settings and increased practitioner engagement in STEM professional learning opportunities **(Excellence)**;
- significant reductions in the equity gaps in participation and achievement in STEM learning, engagement, study, courses and training across all sectors in relation to gender, deprivation, rurality, race, disability and for care leavers **(Equity)**;
- increased numbers of people who understand the benefits and value of STEM for themselves, their families and their communities **(Inspiration)**;
- increased collaboration between schools, colleges, universities and employers **(Connection)**; and
- increased employment in STEM-related occupations and employers are more satisfied with the STEM skills and capability of the people they employ from schools, colleges, universities and from apprenticeship programmes **(Connection)**.

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Excellence

As a result of the actions in this section, by 2022, we expect to see:

- Increases in the proportion of people undertaking STEM-related learning, engagement, study and training across all sectors including in school-level qualifications and awards, and participation in apprenticeship programmes.
- Increased practitioner confidence in STEM learning in the early years, primary years and in CLD settings, and increased practitioner engagement in STEM professional learning opportunities.

To successfully meet the growing demand and requirements for STEM skills, we must ensure that we are a nation that builds its STEM enthusiasm, skills and knowledge. Achieving this requires excellence in the education offered in early learning settings, schools, colleges and universities and in our wider communities. We need sufficient teachers and practitioners in our education system who are well equipped with the knowledge, skills and confidence to develop and deliver inspirational, high-quality interdisciplinary STEM teaching for all learners, across all ages and stages. In particular we must ensure that all children and young people get the grounding in STEM that they will need in later life through early learning and in the Broad General Education.

Teacher recruitment in Scotland, as in many other countries, is challenging. Many local authorities experience difficulties in filling vacancies in some secondary subjects, with STEM subjects being a particular issue. Teacher education universities face similar challenges in recruiting sufficient student teachers in STEM subjects.

Effective career-long professional learning is vital to allow teachers and practitioners to develop their STEM knowledge and skills. There was strong support in the response to the strategy consultation for more and improved STEM resource, training

and support for teachers and practitioners, and in particular for those working in primary schools and early years settings. The consultation also indicated a requirement for more professional learning and collaboration in STEM, beyond the core STEM disciplines and across sectors including early learning, schools, colleges and community learning.

As well as ensuring a good supply of STEM talent into the workforce and keeping practitioners' skills up to date, the curriculum and programmes of STEM learning need to be of high quality. Courses should be relevant to business and employer requirements and real-life contexts, and should help equip learners with the skills they need to thrive in work and in their wider lives. It also means providing a sufficient range of learning pathways through schools and on to positive destinations.



In responding to these challenges, we will promote **Excellence** by:

- improving the supply of STEM talent into the teaching profession;
- delivering a new, enhanced STEM professional learning package for practitioners, teachers and technicians;
- introducing new measures to improve STEM learning and teaching;
- prioritising STEM in the expansion of apprenticeships; and
- maintaining research excellence in our universities and forging closer links between universities, colleges and industry. This theme and the important role of colleges and universities in ensuring learners have the necessary skills to meet the needs of employers is further developed in the chapter on Connection.

Improving the supply of STEM talent to the teaching profession

We need to have the appropriate number of STEM teachers throughout Scotland's schools. We are currently experiencing shortages in numbers of mathematics, computing and some science subject teachers. In order to help address this, new STEM-focused courses commenced at a number of universities from August 2017. These include courses at the University of the West of Scotland and the University of Stirling to enable primary and secondary teachers to develop specialist STEM knowledge and teaching approaches, and a course at the University of Glasgow that will enable practitioners to teach mathematics from P6 through to S3. Evaluation mechanisms have been built into the accreditation process that is managed by the General Teaching Council for Scotland (GTCS). These developments will be supported by the next phase of the *Teaching Makes People* recruitment campaign and through the tender to develop a new route into teaching, specifically designed to attract high-quality graduates in priority areas, including STEM subjects. We will also make sure that teaching is highlighted as a potential career to STEM graduates through the action we are taking in this strategy on careers advice and guidance.

We will attract high-quality STEM graduates into teaching through the *Teaching Makes People* recruitment campaign and through the proposed new routes into teaching.

In addition, we have recognised the need to reach beyond recent graduates and attract people into STEM subject teaching in secondary schools who are working in business or industry. These "career changers" will require a degree in a relevant subject and also undertake initial teacher education before they can become teachers. However, we want to make it easier for them to make that career change by providing help to enable them to balance family and financial responsibilities that new graduates may not face. We will provide targeted help to enable career changers to choose a career in secondary teaching in a shortage STEM subject. Currently these are mathematics, computing and technical education. We will keep these under review from year to year.

Starting in August 2018 we will offer bursaries of £20,000 to eligible career changers to allow them to undertake an initial teacher education course and qualify as a teacher in one of the STEM shortage subjects.

In taking these steps to increase the recruitment of STEM teachers, we will also ensure initial teacher education provided by universities prepares students to enter the profession with consistently well-developed skills to teach numeracy.

Education Scotland will develop a self-evaluation framework to allow each initial teacher education university to evaluate their initial teacher education programmes including how their programmes equip new teachers with the skills required to teach numeracy across the curriculum. The framework will be available in time for universities to start this work during academic year 2017-18.

Delivering enhanced STEM professional learning

The *Education Governance: Next Steps* document included a commitment to deliver a more streamlined, coherent offer of professional learning for practitioners throughout their careers. At the national level, Education Scotland will lead career-long professional learning (CLPL) for practitioners, supported by a range of professional learning providers.

Through the development and delivery of a new and significantly enhanced professional learning package in relation to STEM, all early learning practitioners, primary and secondary teachers, technicians and community learning and development practitioners will have the opportunity to build their capacity to deliver effective STEM learning. We will ensure that practitioners and technicians are able to access CLPL in a variety of ways to meet their individual needs. For example, this could include face-to-face-training, online learning and webinars, learning from peers and networks within their school clusters or with colleagues from the college, early learning or community learning and development sectors. The learning could be developed and delivered from a range of sources, including by practitioners themselves. We recognise that many employers are interested in supporting STEM learning in the classroom, and the Learned Societies covering the range of STEM disciplines also have a wealth of expertise from which we can draw. We will seek to involve them in a coherent and co-ordinated manner. By 2022 there will be a demonstrable improvement in practitioner confidence in delivering STEM learning and evidence of increased engagement in professional learning.

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Education Scotland will work with partners and, in particular, practitioners, to develop a coherent national approach to STEM professional learning from early 2018. This will include the development of a new national online resource for STEM and an online professional learning offer for early learning practitioners, primary and secondary teachers, technicians and community learning and development practitioners. New opportunities will become available during academic year 2018-19.

As part of this Skills Development Scotland will lead work to provide professional learning to help practitioners contextualise STEM learning from early 2018. This will ensure learners are able to relate their learning and skills to real-life situations, their future careers, and the economy.



Case Study

Shaw Mhor Early Years Centre, Glasgow City Council

At Shaw Mhor Early Years Centre, STEM is fully integrated into learning experiences. Shaw Mhor staff have been working in partnership with their colleagues in their associated primary and secondary schools through their involvement in Education Scotland's National STEM Project. This has allowed them to share approaches and plan collaboratively with colleagues in other settings, for instance, to develop STEM bags for children to take home to engage parents in STEM learning. Staff and the wider community now actively tackle gender stereotyping and encourage both boys and girls to get involved with 'hands-on' activities, including those focused on engineering and construction. The Centre makes extensive use of its outdoor areas for learning and play.

Examples of activities include:

- **tinker box** – children use real-life tools to develop a range of STEM skills and understanding. This included using a screwdriver to make holes of varying sizes, teasing out the child's understanding of size and measurement;
- **make desk** – straws are used to construct a shelter and then painted. The paint is made by the children themselves, developing their curiosity and problem-solving skills; and
- **construction area** – the Early Years Centre developed an innovative partnership with Scottish and Southern Electric (SSE) who supplied hard hats and barriers and helped them to develop a realistic construction-based learning area outdoors.

The focus on STEM at the centre means learners are confidently using scientific vocabulary, developing their investigative and inquiry skills, and are able to ask questions and solve problems.

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The early years are crucial in providing a foundation in STEM skills and in inspiring and igniting children's enthusiasm. The outdoor learning environment, in particular, provides a rich and exciting context for young children's STEM learning. In supporting the expansion of funded early learning and childcare, we will ensure early learning and childcare (ELC) practitioners have the appropriate skills, knowledge and confidence to support young children in relation to STEM, as part of the wider work on developing a coherent cross-sector professional learning offer.

As part of a wider programme of CLPL designed to support the expansion of funded early learning and childcare, we will work with partners and key stakeholders including science centres and science festivals to deliver STEM training that will ensure that ELC practitioners have appropriate skills, knowledge and confidence to deliver STEM learning in ELC settings. This will also form part of the coherent national offer for STEM CLPL set out above.

We will set out plans to enhance opportunities for outdoor learning in STEM in the ELC Quality Action Plan.

The coherent approach will build upon the opportunities that will continue to be available through our existing programmes. We will continue to support the Scottish Schools Education Research Centre (SSERC) to provide high-quality programmes of learning for teachers, and technicians, on science and technology in both primary and secondary schools. We are also supporting local authorities to take strategic action to improve STEM learning in primary settings through the *Raising Aspirations In Science Education* (RAISE) programme, in partnership with the Wood Foundation.

Through delivery of the recommendations of the *Making Maths Count*⁶ report we are aiming to transform public attitudes to mathematics, improve confidence and fluency in mathematics for children, young people and their families, and promote the value of mathematics as an essential skill for every careers. As part of Making Maths Count we held an inaugural Maths Week Scotland in 2017. We will build on this to establish Maths Week Scotland as an annual event to raise the profile, value and relevance of mathematics and to highlight the vital role of mathematics in education. During Maths Week we launched the Deputy First Minister's

Maths Challenge which will now run in each of the main school holidays every year. Our National Numeracy and Mathematics Hub provides professional learning and teaching resources in mathematics and numeracy for all teachers in all settings and for parents to encourage learning at home.

The Scottish Attainment Challenge is providing targeted support to local authorities to help them close the poverty-related attainment gap in numeracy. Our *Read, Write, Count* programme supports and motivates parents to continue learning outside school through resources for home learning for all P1 to P3 children and, starting last year, places an enhanced focus on encouraging parents to undertake numeracy activities at home through its social marketing campaign.

We will provide ongoing funding and support for improvements to STEM learning in the classroom in both primary and secondary schools through the SSERC, the National Numeracy and Mathematics Hub, the Scottish Attainment Challenge and the RAISE programme.

The importance of CLPL in driving educational excellence is equally relevant to the tertiary sector. It is essential that STEM students in further and higher education benefit from teaching and research that is informed by developments and advances in the variety of STEM disciplines, with improved input on the needs of industry and the economy being a key influence in shaping a constantly evolving and responsive curriculum.

We will increase opportunities for STEM-related CLPL in colleges and universities by working with the Energy Skills Partnership, College Development Network and the Digital Skills Partnership to ensure lecturers are provided with high-quality skills development within STEM curriculum areas.

Improving STEM learning and teaching

As part of the Government's Education Reform programme, Regional Improvement Collaboratives will be established to embed and support collaboration for improvement across the education system. They will:

- reduce inconsistencies in the improvement support that schools across Scotland access, by providing an enhanced support offer;

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6 <https://beta.gov.scot/publications/transforming-scotland-maths-positive-nation-final-report-making-maths-count/>

- bring a collective focus to driving continuous and systematic improvement, particularly in relation to closing the attainment gap; and
- strengthen and support collaborative working, innovation and the sharing of best practice between schools and across the education system.

They will do this by drawing on local and national expertise to identify and share effective practice, and create opportunities for education professionals working in different sectors and different local authorities to learn from one another. They will also support wider collaborative working across the system between early learning and childcare settings, schools, community learning, colleges, universities and industry to help create highly motivating and relevant STEM curricula that excite and engage learners, their parents and their communities. By doing so the Collaboratives will improve support for practitioners, teachers and headteachers to deliver excellence and equity in education.

Whilst the detailed operation of Improvement Collaboratives will be outlined in their operational plans, there are a number of ways in which they could support the STEM agenda:

- promoting effective strategies and approaches for parental engagement and family learning in STEM in early learning and childcare settings and schools;
- supporting school cluster and partnership working for STEM to promote joined-up planning and delivery of programmes of learning so children and young people are able to develop the foundations they need to move onto the next stage;
- promoting the links between STEM learning and raising attainment in literacy and numeracy;
- building and boosting the teaching and learning of STEM in early learning and primary schools in terms of both STEM skills and knowledge and teaching approaches; and
- promoting skills progression in STEM learning, including through engagement with the curriculum benchmarks and bringing real-life examples from the world of business and research into STEM learning.

We will work with partners to support the work of the Improvement Collaboratives in their identified priorities for STEM learning, teaching and engagement.

As part of the consultation on the draft strategy, we sought views on a draft STEM Self-Evaluation and Improvement Framework. This set out a clear and simple approach for local authorities, schools and early learning providers to improve their STEM curriculum and whole-establishment and community approaches to STEM in line with the aims of this strategy. Consultation responses were positive about the draft and we will publish a finalised Framework that addresses the feedback received. The Framework will be widely communicated through local authorities, schools and early learning providers for use as a tool to support improvement in STEM learning and teaching and complement the work that local authorities already do to promote STEM learning.

We will publish the finalised STEM Self-Evaluation and Improvement Framework by December 2017 to support ELC settings and schools in the delivery of STEM learning and teaching.

In order to fully realise the opportunities presented by the Collaboratives to improve STEM learning and teaching, we believe that dedicated STEM expertise will be required to provide specialist support. Building on the Attainment Advisor model, we will appoint STEM specialists that will drive improvement within regions and foster collaboration between regions. They will promote the opportunity to build STEM knowledge and skills into the curriculum through interdisciplinary learning and support the building of STEM capacity within school clusters.

We will recruit a network of STEM specialist advisors to support learning and teaching in the 3-18 curriculum and raise STEM attainment, with the aim of having a fully operational network by December 2018.



Case Study

Port Ellen Primary School

Port Ellen Primary on Islay is an award-winning school that has a passion for STEM. The resourceful staff engaged learners of all ages in many exciting and motivating STEM learning experiences such as:

- practical investigations on plate tectonics and construction of pneumatic monsters;
- participating in the rocket seeds experiment using seeds that have been to the International Space Station;
- taking part in the Scottish Mathematics Challenge;
- learning about algorithms, computational thinking and game design; and
- linking STEM to learning for sustainability through Eco-Schools topics.

The school also makes use of its stunning location to bring STEM to life by working regularly with the RSPB and by visiting the Hebridean Whale and Dolphin Trust boat to enhance learning about animal communication. They are also working with Reading University archaeologists to carry out geophysical surveys of local historic sites.

The school is working with colleagues from other schools to promote effective cluster-wide approaches to science through SSERC's Primary Cluster Programme. In addition, student STEM ambassadors from Islay High help run a popular after-school club.

Maureen McDonald, Headteacher, Port Ellen Primary

"As educators at Port Ellen Primary School, it is important that we equip our children with skills for learning, life and work. Through our work in STEM, we have created a culture and environment that enables our learners to apply their thinking in real-world applications. Our interdisciplinary methodology in STEM is a creative and inclusive approach which stimulates and motivates the youngest to the oldest learners. When children are interested and engaged to this level, it not only helps to raise attainment and achievement, it also harnesses the enthusiasm of our parents, partners and community creating a STEM domino effect".

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We recognise the particular critical importance of people having both broad digital skills and the specific computer coding and cyber security abilities that are in particularly short supply in the economy and are increasingly needed for everyday life. Earlier this year we updated the early years and school curriculum to introduce the fundamentals of coding and cyber security from the earliest years of education onwards and to ensure these are developed right through the Broad General Education. Through partnerships with industry we are supporting the practical delivery of this in schools with the *Barefoot Computing* programme, the expansion of extra-curricular activities and coding clubs, the Digital Schools Programme and the creation of a Digital Schools Award for primary and secondary schools.

We will provide dedicated support to digital skills development in early learning settings and schools, including primary schools, through the Digital Schools Programme.

We recognise that practical experience is an important part of STEM learning and are clear that opportunities to carry out experiments and engage in practical investigations and activities should be an integral part of STEM learning across all ages and stages. Many practical activities can be done in standard classroom settings but dedicated facilities are also needed, particularly at the more advanced or specialist levels.

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We will work with local authorities to ensure that excellent spaces for STEM learning are included in new builds and developed through school refurbishment projects. We will make this a key consideration of the Scottish Government's support to any project(s) delivered through any future schools investment programme.

Prioritising STEM in the expansion of apprenticeships

Scotland's Labour Market Strategy (LMS) published in 2016 redefines the Scottish Government's strategic direction for our labour market. Our Apprenticeship Programmes are an important example of how the Scottish Government can both deliver the LMS and also make a significant contribution to the promotion and expansion of STEM-focused support for individuals and businesses.

We are committed to further expanding STEM opportunities across all apprenticeship offers, promoting these opportunities as widely as possible, and enhancing our understanding of pathways into, and from, these apprenticeships to ensure Scotland's labour market meets both our current and future needs.

Apprenticeship Frameworks are driven by industry demand and SDS works closely with employers and training providers to ensure that apprenticeships are developed and delivered in line with employer needs. SDS established the Scottish Apprenticeship Advisory Board, following recommendations from Developing the Young Workforce (DYW), and it is designed to give employers and industry a leading role in informing the future of apprenticeships in Scotland. Vocational provision, such as Modern, Foundation and Graduate Level Apprenticeships have grown significantly since the DYW programme commenced and this will continue to expand during the remainder of the programme.

Foundation Apprenticeships, available as part of the Senior Phase in school, have seen an annual increase in uptake since being introduced in 2014. They are delivered as a partnership between school, employer and college and offer real workplace experience as well as leading to an industry-recognised qualification and are available in all local authority areas. We aim to make 3,500 places available for a 2018 start date – with 5,000 places available by the end of 2019. Approximately half of all Foundation Apprenticeships will be

in STEM subjects with seven of the ten current frameworks on offer being STEM-related: civil engineering, creative digital media, engineering, financial services, IT hardware/system support, IT software development and scientific technologies (laboratory skills).

During 2016-17, 37% of all Modern Apprenticeships starts (almost 10,000) were STEM related, with 57% (21,139) of all those 'in training' in STEM frameworks. It is intended that the annual number starting a Modern Apprenticeship will rise from the current level of just over 26,000 to 30,000 by 2020.

Graduate Level Apprenticeships (GLA) provide an opportunity to develop a new way into degree-level study alongside work. GLA provision will increase from 379 places available in four frameworks in 2017 to 520 across seven frameworks in 2018, all of which will be in STEM subjects.

The planned expansion of both Foundation Apprenticeships and Graduate Level Apprenticeships in the coming years will facilitate improved pathways in STEM-related work-based qualifications.

We will prioritise STEM in the expansion of Modern Apprenticeships and the development of Graduate Level Apprenticeships and Foundation Apprenticeships. This will start in 2018 and continue for the five year lifetime of this strategy.

Maintaining excellence in STEM research and building links with industry

Scotland's universities lead the world in research across many STEM disciplines, ensuring that both postgraduate and undergraduate teaching are informed by that research excellence. In addition, this cutting edge research enhances Scotland's innovative reputation and potential to further capitalise on the competitive advantage this reputation affords. Building on our investment through the Scottish Funding Council in world-leading STEM research and researchers, there is an opportunity to connect this activity more strongly with the support given to Scotland's companies to plan and invest for growth. Our Innovation Centres are already working to link businesses to academia in both present and future industries and shaping the jobs of the future for those leaving our colleges and universities. The creation of the new Enterprise and Skills Strategic Board will provide a means of further improving this collaboration in the future.

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Scotland's new Enterprise and Skills Strategic Board will work with the enterprise and skills agencies, including the Scottish Funding Council, to improve collaboration on all aspects of STEM education between colleges, universities and employers to support productivity and growth. The Strategic Board will ensure that the enterprise and skills agencies align behind a strategic plan to drive Scotland's economic ambitions, and the promotion of growth areas related to STEM disciplines will feature in its consideration.

Our Innovation Centres will continue to improve the effectiveness and impact of links between businesses and academia, and influence jobs of the future. In particular, Innovation Centres will increase their promotion of STEM and its practical applications to help inspire school pupils and students to develop their STEM skills for a range of careers.



Case Study

Innovation centres – Data Lab

Innovation Centres receive support from the Scottish Funding Council for postgraduate taught places with an emphasis on the development of Masters-level provision. Programmes include placements providing on-the-job training where the industry partner benefits from the knowledge of a highly-skilled postgraduate student.

The Data Lab MSc is a collaborative effort between seven Scottish universities with the aim of developing the data science talent and skills required by industry in Scotland. Last year Data Lab provided a number of placements in companies around Scotland. Urban Tide, a SME-based in Edinburgh, specialising in smart cities services hosted an MSc student, Christopher Lunny, as part of the Data Lab MSc placement programme. The goal was to test USMART's real-time data performance using Transport for London data to answer the question 'how well do the buses adhere to their timetables?'. Christopher said:

"I'll hopefully get a chance to work with UrbanTide again in the future – which would be really great because there's a very good balance of young and enthusiastic, very bright, people there with fresh ideas along with more experienced people with sound wisdom and leadership skills."

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7

Equity

As a result of the actions in this section, by 2022, we expect to see:

- **Significant reductions in the equity gaps in participation and achievement in STEM learning, engagement, study, courses and training across all sectors in relation to gender, deprivation, rurality, race, disability and for care leavers**

The data shows that there is a pressing need for greater diversity of people taking STEM courses and training programmes and employed in the STEM sectors. We need to achieve a better gender balance and address the negative impact of social disadvantage in STEM courses, training and work. There are other disparities in participation and achievement in STEM in terms of race and disability that must be tackled.

Gender imbalances in participation in STEM courses are evident across the education and training system. Overall, girls are under represented in STEM subjects at school. Two thirds of STEM learners at college are male and men outnumber women in the number of Modern Apprenticeship registrations in STEM frameworks. There are wide variations in the pattern of female and male participation in the different STEM subjects and courses with males being over represented in subjects such as physics, engineering, computing and construction.

Conversely, females are over represented in subjects and courses relating to biology, life sciences, medicine, dentistry and veterinary science. For example, in 2016, 67% of Higher Biology and 71% of Higher Human Biology of total passes in the subject were by females whereas only 18% of Higher Computing Science and 30% of Higher Physics passes were by females. In 2016, the percentage of female passes in Higher Mathematics, Chemistry and all the other Technology subjects were 48%, 51% and 44% respectively.

This gender segregation and imbalance is exacerbated in the STEM workforce. Research indicates that women are under represented across a range of STEM sectors such as energy, life and chemical sciences, engineering and ICT/digital and, in particular construction, where in 2015 less than 2% of trade workers and only 10% of professionals were female. Other sectors, in other parts of the economy, such as the care sector have high proportions of women. Gender segregation and imbalance results in lost economic potential for the country and missed opportunities for individuals.

We recognise there are broader societal issues that need to be tackled. Equality for women is at the heart of the Scottish Government's vision for an equal Scotland and we are taking a range of actions to tackle the gender pay gap, ensure women's equality in the workplace and to ensure women are represented in senior decision-making roles, including in boardrooms. We will also continue to consider the need for, and support, positive action projects that address gender imbalances in STEM sectors of the economy.

Tackling the equity gaps in the education, training and lifelong learning system is critical in order to diversify and increase the pipeline of talent into the STEM economy and to create equality of access, opportunity and outcomes for all. It will require sustained action and investment co-ordinated across sectors.



1 in 3
of college enrolments
were female 2015-16



In responding to these challenges, we will promote **Equity** by:

- introducing new measures to tackle inequality and inequity, including gender stereotypes, in STEM learning and careers from the early years onwards;
- tackling targeted action to improve participation in STEM further and higher education courses and apprenticeships; and
- introducing new measures to increase access to public science engagement events by under-served groups including a focus on audiences in deprived and rural areas.

Tackling inequity in STEM learning and careers

Gender stereotypes are a major factor contributing to imbalances across participation in STEM subjects at all stages of education in Scotland and into employment. We recognise the negative influence these stereotypes can have, particularly in discouraging girls and young women from studying STEM, and are committed to tackling this.

Since 2015, Education Scotland, Skills Development Scotland and the Institute of Physics have been collaborating in early learning centres and schools to develop effective approaches to tackling gender imbalances at the classroom level.

Conclusions from this work have been that:

- concerted action needs to be taken in early learning and primary provision to tackle the stereotyping around toys, clothes and play and other deeply-ingrained cultural practice and beliefs which are prevalent in society and which help perpetuate gender inequality;
- a sustained focus is then needed through secondary schools to ensure progress is maintained and that boys and girls continue to have a high level of engagement and enjoyment in STEM subjects through the Broad General Education and into the Senior Phase;
- young people and girls in particular need to be supported and encouraged to continue on their STEM journeys. Whole-school approaches to gender equality are needed as the issues which affect subject choices and career aspirations go beyond STEM departments in schools; and

- a coherent approach is then required to support the transition of learners from schools into leadership, work, training and further study. Mentoring schemes, appropriate marketing of courses, industry and open day visits can help to build the confidence of learners and help them make effective non-gendered choices.

The learning from this project has already started to be disseminated widely throughout schools. We want to extend and deepen the impact of this project in early learning settings and schools, widen it out beyond STEM to other curricular areas and, as appropriate, other equalities issues. In doing so we want to actively work with equalities and equity experts in the third sector and to join up our activities with similar work being undertaken in colleges, universities, public science engagement and the apprenticeship programmes.

We will work with early learning providers and schools from June 2018 to help them recognise and address unconscious bias and gender stereotyping and tackle inequity. This will include the development and delivery of new professional learning programmes on equity in STEM for practitioners. We will seek to embed good practice from the successful Institute of Physics *Improving Gender Balance* project across all schools by 2022. We will create a dedicated resource to lead, manage and support this work and will involve equalities experts in the third sector.

We are making a significant investment in closing the poverty-related attainment gap, focussing on numeracy, literacy and health and wellbeing. A wide range of strategies and approaches are being applied across the authorities and schools participating in our attainment programmes. We have extended *Read, Write, Count* into P4-P7 in areas of high socio-economic deprivation to further support parental engagement in these key areas from April 2017.

Using information from the Scottish Attainment Challenge we will review the impact and effectiveness of numeracy and STEM-related activity to reduce the poverty-related attainment gap by March 2019. We will share what we know about effective practice through the National Improvement Hub and wider STEM schools programmes and networks, in order to help inform future decisions on the use of funding in schools.



Case Study

Equate Scotland and FanDuel

Equate Scotland and FanDuel have been working together for two years to develop a holistic approach to increase women's representation in the company and across the tech sector. Over these two years FanDuel has invested in:

- unconscious bias training;
- flexible work practices;
- equality and Diversity training for managers;
- a women and leadership training day;
- outreach work and film screenings for women students from colleges and universities who are studying technology or engineering; and
- strategic development on gender equality with their leadership team.

A number of different interventions and approaches have been used over the last two years in recognition that occupational segregation in STEM will not be overturned through a 'single silver bullet', but rather through multiple interventions at all levels of a company, which are embedded into workplace culture.

Sarah, second year Software Engineering student, on attending events at FanDuel: "It was fantastic to hear from the female employees at FanDuel, especially to hear their journeys and how flexible and supportive the company is towards them. Going to events with employers where we can hear about what they are doing for women makes me more confident about working in tech."

Maria Rooney, Talent Director, FanDuel: "Tackling the gender technology gap is a priority for us both internally and also within the wider tech community. We are passionate about providing opportunities at every level of the pipeline through inspiring students to ensuring that we recruit and retain incredible talent."

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Skills Development Scotland published its Equality Action Plan for Modern Apprenticeships in Scotland in December 2015 and an update in July 2017, which connects with the aims of this strategy. The plan outlines the actions that Skills Development Scotland is taking in collaboration with partners to reduce gender stereotyping and gender segregation in career choices and occupational routes chosen by young people.

Skills Development Scotland will continue to develop its approach to support key influencers (teachers, parents, career advisors and peers) to challenge assumptions of traditional career choices and encourage under-represented groups to take up STEM apprenticeship opportunities. This will include embedding equality considerations in the quality assurance of apprenticeships provision.



Case Study

Improving Gender Balance Scotland (IGBS)

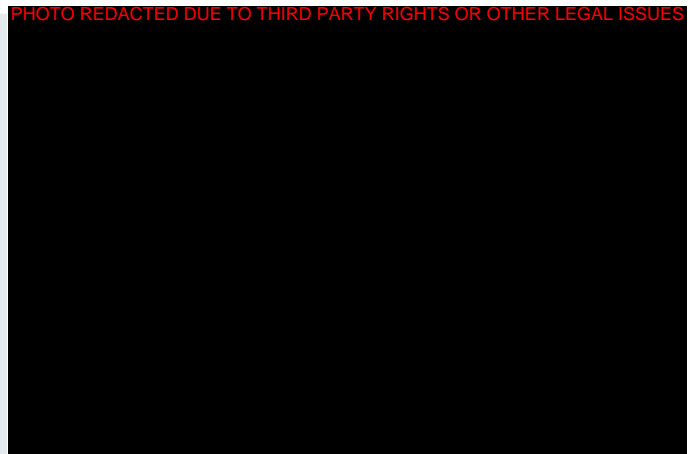
IGB Scotland is working with schools to tackle the persistent under representation of girls in STEM subjects. The project aims to establish school interventions to effect long-term cultural change with a particular focus on challenging gender stereotypes and encouraging more gender balance across STEM occupations. The project is a collaboration between the Institute of Physics, Skills Development Scotland and Education Scotland.

IGBS works with school clusters, from early years to S6, and with all members of the school community including students, teaching staff, parents and the senior leadership team. The focus of the project is helping practitioners and senior managers within schools and early learning centres understand gender stereotyping and unconscious bias, and develop approaches to tackle them. The interventions are evidence-based and are carried out by the schools, facilitated and supported by the IGBS Project Officers.

An external interim evaluation reported some key successes and changes in the schools participating in the early stages of the project:

- greater awareness amongst teachers and senior managers of unconscious bias, including gender bias – and how it manifests itself within their activities and what steps need to be taken to promote gender balance; and
- greater awareness of gender issues among learners – with this feeding into students talking about gender issues more often. For example, a number of teachers highlighted that students are more likely to confront bias, stereotyping or throwaway remarks than in the past.

Chris Deaves, Deputy Headteacher, Auchmuty High School said: “Our involvement with the IGBS project has been a real eye opener for the whole school community. Our collective attitudes, unconscious bias and entrenched positions are now being challenged.”



93%

Modern Apprenticeship
starts are male

As part of the DYW programme, the introduction of the Foundation Apprenticeships in Scotland offers a new opportunity for young people to benefit from earlier experience of work-based learning. Foundation Apprenticeships can broaden career opportunities for young people and make them better equipped for employment as they undertake real work experience with an employer. The current contracting arrangements for Foundation Apprenticeships embed equality considerations within the requirements and we expect that expansion strategy for Foundation Apprenticeships will be a key route for encouraging more diverse routes and innovative and wider career choices for young people from all backgrounds.

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Skills Development Scotland will work with partners at a local level to increase female uptake of Foundation Apprenticeship STEM-related programmes, starting in 2018 and continuing until 2022.

Improving participation in STEM further and higher education courses and apprenticeships

The established partnerships that both colleges and universities have with schools offer the opportunity to encourage more young women to study STEM subjects. In particular, highlighting examples of women in STEM careers and their journey to obtaining rewarding jobs offers a practical way to inspire and attract more women to study and research STEM subjects and embark on associated future careers. Through management of the existing Outcome Agreement process, the Scottish Funding Council will assist and challenge universities and colleges to play an enhanced role in encouraging gender balance in the take up of STEM study. However, further action is required to raise awareness of the opportunities and to accelerate progress.

We will launch a new social media campaign in 2018 to increase gender balance in participation in STEM study and to address STEM occupational segregation. This campaign will be led and championed by Scottish Government, Scottish Funding Council and the college and university sectors. Each college and university has developed a Gender Action Plan, and through the Outcome Agreement process we will monitor their work to implement actions on advancing equity to reduce gender disparities for learners within STEM subject areas.

The Scottish Funding Council will produce an inaugural annual progress report on institutional performance in this area in December 2017.

Alongside action to close the gender gap, we are also committed to address inequalities associated with socio-economic deprivation. This will involve working with the Scottish Funding Council as their new school engagement framework takes shape. The existing programme, Access to High Demand Professions, and its REACH element, already focus on assisting pupils from deprived backgrounds, in schools with a low rate of

progression to higher education, to access degree courses in subjects such as veterinary medicine, medicine and dentistry. This will be augmented through the development of the Scottish Funding Council's national school engagement framework, with the aim of improving access and enhancing skills for careers in key STEM industries, such as ICT. We will also scope the potential requirement for universities to develop a new targeted geographical outreach programmes related to STEM subjects.

Using the Scottish Funding Council's new school engagement framework, which will launch in 2018 and be fully implemented by 2020, we will identify new ways of opening up opportunities in STEM study by breaking down gender barriers and encouraging prospective students from deprived areas.

Within the apprenticeship programmes, Skills Development Scotland will take steps to increase the take-up of STEM apprenticeship opportunities by under-represented groups, as well as working with employers to help them recruit and support STEM apprentices from more diverse groups in their workforce.

Skills Development Scotland will increase diversity and equity across Scotland's apprenticeship programmes through a targeted package of employer engagement, engagement with under-represented groups and mentoring for young people, starting in early 2018.

Increasing access to public science engagement events

Public science engagement providers have the potential to reach large sections of the Scottish population. We recognise the particular need to take specific, targeted action to ensure that the opportunities offered by our world-class science centres and by our inspirational festivals can be enjoyed by all of Scotland's communities, particularly those currently under represented in STEM learning and careers. Scottish Government funding is a key lever to incentivise this aim and we will aim to maximise the impact of our activity on under-served individuals, groups and communities by directing more of our funding towards science engagement activities delivered in areas that are rural and remote, or deprived.



Case Study

University of Strathclyde – Engineering Academy

Established in 2013, the Engineering Academy (EA) is a model widening access initiative providing students with a route to a University of Strathclyde degree via an enhanced HNC programme and work placements delivered by college and industry partners.

The EA also offers students the chance to engage with sponsoring companies who mentor EA students throughout their studies and support their professional development, whilst also providing paid summer placements. This allows students to put the theory they learn into practice and get hands-on industrial experience, enhancing their CVs and employability.

We have worked closely within our college partnership and their well-established schools links. This has led to us being invited to a number of parent, pupil and teacher events organised by our partner colleges or local authority. These have proved to be effective in increasing awareness and engagement. Our focus going forward is to engage directly with targeted schools, some of this work has already started. The early indications are extremely positive demonstrated by the level of engagement with the school Heads and their Departmental Heads. The focus of these engagements has been to establish a viable pathway for their Senior Phase into engineering using the academy route.

Paul Bain, MD Wabtec Faiveley: “We are now two years through the journey and I feel a win-win for Wabtec students and the university has been achieved. Wabtec has gained so much to date. The proactive nature of our students has been incredible and has had a significant impact on the staff.”

Student Michaela Silver-Woods (pictured): “Studying in the Engineering Academy’s General Engineering has had so many benefits for me. It meant I could choose between five world-class departments at Strathclyde, and I also had a stand alone qualification for my first year of study. There are lots of exclusive recruitment opportunities. Thanks to this I have an amazing placement abroad with a great company.”

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We will conduct an in-depth analysis of deprivation and rurality to understand how best to reach under-served audiences. This will inform the use of our public science engagement funding in 2018-19 and beyond.

We will support the science centres to continue to target activities at particular groups currently under-served by science engagement activities, through use of our Community Subsidy. This will include close working with communities and other groups to make sure that activities meet their needs, whether through events in centres or delivered through outreach to community venues.

We will require science festivals to promote at least one event specifically targeted towards women and girls from 2017-18 onwards as a condition for accepting our funding.

The Community Learning and Development (CLD) sector also has a key role in promoting equity through engaging disadvantaged or vulnerable groups and individuals of all ages in learning. CLD practitioners have identified the lack of low-cost or free STEM activities as a barrier for young people, adults, families and communities engaging with STEM. Increasing partnership working between the CLD sector and the public science engagement sector would help extend the reach of these activities into communities with high levels of socio-economic deprivation.

We will require science centres and larger science festivals to work with the CLD sector to develop Community STEM Plans from 2018-19 onwards as a condition of Scottish Government funding for public engagement activities.

These plans will set out clearly their commitment to engage with diverse audiences and measure learning outcomes of their activities with key groups. As a part of these plans, we will also look to develop new opportunities for young people and families to engage with STEM in communities that experience high levels of deprivation through joint working between the CLD sector and the science centres and festivals.

Education Scotland will work with the science centres and science festivals in Edinburgh, Glasgow, Aberdeen and Dundee on a pilot basis to extend the reach of their programmes to parents and families in designated SIMD areas, starting in 2018.

8

Inspiration

As a result of the actions in this section, by 2022, we expect to see:

- **Increases in the proportion of people undertaking STEM related learning, engagement, study and training across all sectors including in school-level qualifications and awards, and participation in apprenticeship programmes.**
- **Increased numbers of people who understand the benefits and value of STEM for themselves, their families and their communities.**

Scotland has a rich history and culture of expertise, innovation and achievement in STEM that is recognised around the world. Yet there persists a view within our society that STEM subjects are more difficult to study than others, as well as an under-appreciation of the vital contribution of STEM to our culture. The need to challenge such societal perceptions of STEM and to demonstrate the opportunities it presents for all children, young people and adults was a strong message from the consultation conducted in preparing this strategy.

In challenging outdated views, misconceptions and stereotypes related to STEM, it is critical that we recognise the role that parents and families in particular can play as key influencers of young people's attitudes and choices, including the subjects they study and the careers they pursue. Reflecting a wider issue in society, some parents and other family members can lack sufficient awareness of the importance of STEM for future skills and careers and can hold negative perceptions of STEM that are often based on their own prior experiences.

It is likely that these misconceptions about STEM are a significant contributory factor in the 'leakage' that exists currently from the STEM skills supply pipeline in Scotland. Data shows a positive picture generally in terms of the overall growth in STEM Higher and Advanced Higher passes at school, the number of college and university STEM enrolments and the number of STEM apprenticeships. However, not all of those with STEM skills and qualifications take up STEM occupations or work in STEM industries when they leave the education system. Not enough people are sufficiently inspired on an ongoing basis to work in the STEM industries or to develop and maintain their STEM capability throughout their lives.



In responding to these challenges, we will promote *Inspiration* by:

- Creating networks of positive STEM role models, mentors and coaches to inspire children and young people to develop their STEM capability.
- Promoting the opportunities and benefits offered by STEM learning and careers, including fostering a better understanding of the wider cultural, health and environmental benefits of engaging with STEM and helping learners to make informed choices about STEM study and careers.
- Recognising and celebrating the successes of learners and providers in developing their STEM capability.



Case Study

Highland STEM Ambassadors

S6 students devise, plan and deliver STEM sessions alongside Mairi Stewart, STEM coordinator, University of Highlands and Islands. They focus on inspiring younger pupils to enthuse about STEM subjects, challenge stereotypes and raise awareness of the importance of STEM in our world. Delivery is focussed on P7 but is not limited exclusively to P7 pupils. The primary visits are part of the whole-school transition programme which prepares P7 pupils for the move to S1.

- S6 STEM Ambassadors devise and deliver STEM session to each of the associated primaries.
- S6 pupils achieve the GOLD Crest Award.
- Primary pupils achieve CREST STAR Awards.

The STEM activities are designed to inspire those who deliver and participate in them. The S6 Ambassadors develop communication, presentation and organisational skills through their participation in the delivery of STEM events in the High School. They work with younger students on developing their understanding of STEM and encourage them to consider studying STEM subjects as they progress through the Broad General Education and on to the Senior Phase.

Rosie Cord, Teacher, Carbst Primary

“It was a great success! The girls were very professional and lots of learning took place.”

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Creating positive STEM role models, mentors and coaches

Young children have a natural curiosity and affinity for exploring the world around them and being inspired by STEM can start from the earliest years onwards. Early learning and childcare settings have significant contact with parents and families and are well placed to promote positive perceptions of, and engagement with, STEM. Key to this is to raise awareness among parents and families about the importance of STEM within our society and in terms of the future careers and ambitions of their children. Building enthusiasm for STEM within families at the start of formal education will be an important part of our work within early learning and childcare (ELC).

We will, from June 2018, support ELC settings to promote positive engagement with STEM and tackle gender stereotypes through their parental and family engagement activities.

We will, from August 2018, extend the resources available for parents through Parentzone⁷ and, through collaboration with partners, including parent representative organisations and community learning and development partners, support parents and carers with STEM learning at home.

The role of visible and relatable role models in inspiring people of all ages to develop their talents is well established. We know that the most effective type of role model interactions with young people are those which involve sustained interactions and coaching and mentoring. STEM Ambassadors in Scotland, operating within a UK-wide programme, have played an important role in encouraging and inspiring young people to achieve more and progress further in STEM areas. In Scotland, the programme is delivered by three ambassador hubs and managed by SSERC. We believe that STEM Ambassadors and other role models will continue to have a key role in inspiring young people to develop and sustain their interest in STEM study, jobs and careers and we aim to enhance their impact yet further by supporting, in particular, the development of coaching and mentoring for STEM.

7 <https://education.gov.scot/parentzone/>

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We will support STEM Ambassadors to engage with sectors that require more support, such as ELC, parents and families, and community learning and development, with evidence of increases in this engagement by the end of 2018.

We will use digital platforms and web-conferencing to extend the reach of STEM Ambassadors to ensure all schools and settings have access to the support and resources they can provide, with evidence of a broader reach by 2019.

In acknowledging the strengths of the existing programme, we believe that we can inspire yet more young people through the development of a new Young STEM Leaders programme in Scotland that will enable young people to mentor and encourage one another in STEM, in particular for older children to mentor younger ones. A number of early years establishments, schools, colleges and universities already have their own programmes to do this and there was support for these approaches in our consultation. We want to grow and spread these initiatives more systematically.

This will complement the existing STEM Ambassador programme, with a focus on children and young people who are currently in education or training programmes. This is because:

- we know that children and young people respond well to role models who are similar to them;
- mobilising the enthusiasm of young people themselves will help grow the number of role model and mentoring opportunities for other young people; and
- being a Young STEM Leader could, in turn, help motivate that young person to follow STEM study or careers and to become a STEM Ambassador in the future. It will also help them develop 'soft' skills that are in demand from employers.

In doing so, we will make sure that Young STEM Leaders help to address stereotypes that act as barriers to participation in STEM. This will include making sure that there is a good gender balance amongst the Young STEM Leaders.

We will establish a new Young STEM Leaders programme to stimulate and strengthen the development of peer mentoring and inspiration in STEM for children and young people by children and young people. The programme will start in early 2018 and be fully operational by 2020.

Promoting the opportunities and benefits of STEM learning and careers

The Scottish Government provides annual funding for a range of science engagement activities, including Scotland's four Science Centres – Glasgow, Dynamic Earth (Edinburgh), Dundee, and Aberdeen – and typically up to sixteen Science Festivals throughout Scotland in any one year. No other part of the UK has such a comprehensive annual package of support in place for science engagement activities. We will continue to work in partnership with public science engagement providers by providing continued funding to ensure that more than 800,000 people every year have access to quality activities provided by science centres and festivals.

While there is a clear economic imperative to supporting STEM careers and industry, there are wider personal and societal benefits in encouraging people of all ages to engage with STEM. Understanding more about today's big issues, including climate change and our ageing population, can help empower people to make informed decisions about lifestyle choices. Recognising and celebrating Scotland's past, present and future contributions to science and innovation helps embed STEM as an integral part of our wider culture.

We will develop a national engagement campaign, in collaboration with the wider science engagement sector, to inspire and engage people of all ages and backgrounds with STEM.

The campaign will include:

- a 'national week' focus for STEM in Scotland;
- key events across Scotland providing an opportunity to celebrate STEM;
- social media activity and competitions; and
- case study video blogs featuring people in STEM, acting as a resource for parents, teachers and young people.

The campaign will complement other awareness-raising activity, such as Scotland's annual Maths Week which ran for the first time in September 2017. We will make sure that the campaign is inclusive and appeals to the widest possible audience.



Case Study

Maths Week Scotland 2017

Maths Week Scotland emerged from the Making Maths Count report recommendations and is part of the drive to make Scotland more positive in its attitude towards numeracy and mathematics. The first Maths Week Scotland took place over 11-17 September 2017 and it will become an annual event that we hope will build year-on-year in its impact and reach.

Hundreds of schools and thousands of people took part in Maths Week Scotland with a range of activities led by schools, early learning centres, colleges, libraries and universities. Highlights included events in Kelvingrove Park and the city centre streets of Edinburgh and St Andrews, lectures and talks, class and school activities like code breaking, murder mysteries, alien missions, Dragon's Den, escape puzzles, outdoor maths trails and digital maths app competitions. Lots of schools involved parents and carers through inviting them to school and encouraging maths activity at home. Numeracy across the curriculum was celebrated through literacy, science, art, physical activity, languages and history. Some inspiring collaborations emerged between schools and the National Museum of Scotland, the NHS, universities and colleges and many schools engaged with local businesses and employers to promote the diversity of maths and careers.

Lourdes Primary School in Glasgow took part. Pictured, from left to right, are Ahmed Alkhader, Erin Fraser, Abigail McFarlane, and Zoe Boyd. Ahmed said: "I liked Maths Week because we got to go outside to time each other running 100m. We compared our times to Usain Bolt!" Zoe said: "I enjoyed Maths Week Scotland because it was more fun than normal maths!"

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Skills Development Scotland has developed *My World of Work (WoW) Live!* to inspire young people's interest in STEM careers through interactive workshops and exhibits. It brings STEM out of the classroom and into real life by helping young people, parents, carers and teachers understand the breadth of STEM careers, and challenges preconceived ideas about who these are for. My World of Work Live! can be accessed in a range of venues throughout Scotland, including the Glasgow Science Centre.

Skills Development Scotland will build on the success of *MyWoW Live!* by extending provision to reach and inspire more young people into STEM careers including those in more remote and rural locations, starting in 2018.

The catalyst for an interest in a particular STEM subject may come from home, school or when a student has embarked on a different course at college or university. The ability to be, and remain, inspired is as broad and varied as each learner's journey. The cutting-edge nature of many STEM subjects can excite and motivate young people in

pursuing their studies at both further and higher education levels.

We will ensure that learner journeys in STEM disciplines, and particularly the crucial transitions between schools, colleges and universities, deliver the best results for learners. Progression examples may include taking the step from further education to higher education or taking up STEM postgraduate study, when a first degree may not have been in a STEM discipline. From 2017-18, the Scottish Government has expanded the availability of funding for taught postgraduate study at Scottish universities. All eligible students can access a tuition fee loan of up to £5,500 and a loan to help with living costs of up to £4,500. This funding is available to students who wish to embark on a taught postgraduate course up to Masters level.

We will work with colleges and universities to set out, in their outcome agreements, how higher levels of progression from school to further education and onward to higher education STEM courses in a college or university setting can be promoted.

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As part of wider awareness raising of all opportunities available in STEM study after school, we will promote the expansion of financial support for taught postgraduate study from 2017-18.

Scotland's Modern Apprenticeship Programme relies heavily on the commitment of employers across the country, with over 10,000 employers currently engaged in providing opportunities. In 2016-17, 37% of all Modern Apprentice starts were in STEM frameworks. The strategy consultation highlighted support for increased STEM employer engagement in promoting STEM careers and to provide more opportunities for children and young people to experience the sector. The Scottish Apprenticeship Advisory Board includes representation from a number of major national employers, including Scottish Power, Scottish Water and Arnold Clark. The Board is well placed, both individually and collectively, to promote shared messages across their various channels about the value of a career in STEM.

The Scottish Apprenticeship Advisory Board will provide leadership and support in developing a shared approach to promoting the benefits of a career in STEM to key audiences.

Recognising and celebrating success

In encouraging children and young people to build and maintain their passion for STEM-related activity, it will be important to recognise both their individual achievements and the role of providers and partners in creating opportunities for them to flourish. The Digital Schools Award has helped to promote, recognise and encourage a whole-school approach to the use of digital technology in primary schools and has recently been extended to secondary schools. It offers a successful model to extend to other areas of STEM activity.

We will introduce new STEM Awards for ELC settings, schools and CLD settings to promote, recognise and build on activities in these sectors, based on the success of the Digital Schools Award with the first round of awards taking place during academic year 2018-19. We will also explore with partners how the Digital Schools Award may be extended out to early learning and community development settings.

There is a range of CLD-led STEM activity already available across Scotland. This includes:

- the Girl Guides inspiring young women through their *Science Investigator* badge;
- youth awards like the John Muir and Duke of Edinburgh Awards stimulating young people's interest in science in the environment and nature;
- initiatives like *Generation Code* – a partnership between Microsoft, The Tablet Academy, UK Youth and Youth Scotland – offering community-based opportunities for young people to develop their coding skills;
- the Workers Educational Association working with Glasgow Clyde College to develop resources for adult learners on the theme of 'Science for a Successful Scotland'; and
- *Men's Sheds* encouraging intergenerational learning around engineering and technology.

However, the strategy consultation also highlighted that CLD practitioners sometimes do not readily recognise their contributions to the STEM agenda and would welcome STEM professional learning opportunities to maximise their skills. The enhanced STEM CLPL offer set out earlier in this strategy will include bespoke support for CLD practitioners. We will also take further action to raise STEM awareness across the CLD sector

We will hold an annual learning conference each year of the STEM strategy from 2018-2022 for CLD practitioners. These events will be organised in collaboration with partners and showcase inspirational lifelong learning STEM practice.

9

Connection

As a result of the actions in this section, by 2022, we expect to see:

- Increased collaboration between schools, colleges, universities and employers
- Increased employment in STEM related occupations and employers more satisfied with the STEM skills and capability of the people they employ from schools colleges, universities and from apprenticeship programmes

To ignite inspiration for, and foster excellence in, STEM for all of Scotland's children, young people and adults, it is critical that we ensure a collaborative effort between all those with interests in STEM learning and the STEM economy. To deliver a step change in terms of meeting the STEM demand in the economy, we must look at all programmes of STEM learning across the sectors and work to strengthen existing relationships, forge new links, and ensure robust and coherent connections. In particular, we need to strengthen the way that schools and colleges work with employers.

We know there is already a great appetite and willingness to support STEM learning and development in Scotland and to strengthen the connection between education providers and employers. This was evident in the consultation and is demonstrated through the many positive initiatives and interventions taking place the length and breadth of the country.

However, the picture is not a consistent or sufficiently coherent one and the cumulative impact of interventions is not being maximised. The suitability and quality of initiatives, and their geographical reach, can vary. Initiatives also tend to be focused on the Senior Phase, but inspiration for STEM needs to start in the early years, and continue into primary and early secondary education. There can also be a lack of awareness among young people, teachers and practitioners of the opportunities that exist with colleges, local

industries and businesses in their region and beyond. Schools in our more rural and remote communities can find it particularly challenging to identify partners to support STEM learning.

Our Developing the Young Workforce programme has enhanced careers advice for young people including bringing employers closer together with education and introducing careers advice earlier in secondary school. Building on this, the 15-24 Learner Journey Review will set out further improvements in how we can help young people to make well-informed choices about subjects, future study or training and careers.

If we are to create a coherent and connected skills pipeline, our education and training providers must be fully aware of the demands of the labour market and be sufficiently agile to respond appropriately and effectively. Employers have a key interest and role to play, and will be encouraged to develop sustained and meaningful partnerships with schools. Alongside individual employers, the DYW Regional Groups will help by co-ordinating the development of these partnerships. Other employers' groups, including the Industry Leadership Groups, will also have a role in helping to make the connections between employers and the education system and in bringing coherence.



In responding to these challenges, we will promote **Connection** by:

- Improving and streamlining the support available to schools.
- Delivering up-to-date advice and information on STEM careers.
- Increasing the responsiveness of colleges, universities and apprenticeship programmes to the needs of the STEM economy.



Case Study

West College Scotland – STEM Co-ordination

The college hosts the Developing the Young Workforce West Regional team who support the West regions' DYW group. The team work with both employers and college staff to make links between industry and education in the region.

The Bloodhound Rocket Car Challenge has helped provide a focus for partnership working between the DYW Regional Group, schools and the college. This is a large scale STEM challenge project run across Scotland through a number of colleges, supported by ESP (Energy Skills Partnership). The challenge promotes STEM careers for learners at S1-S3 in a fun and competitive environment. It also provides good opportunities for teachers and college staff to build positive and lasting working relationships. Learners design, build and test a model of a land speed record attempt vehicle within a set of engineering design briefs.

West College Scotland supported the training and development of the different partners involved in the challenge and work with participating schools to bring out the benefits for learning and teaching. The DYW partners in the region helped to make contact with the right people in local authorities and schools to involve as many young people as possible. Two hundred learners from the West region were involved in the national "Big Bang Scotland" STEM event run by the ESP at Perth College UHI in June 2017. Inspired by the national event, West College Scotland are planning their own Big Bang Near Me event on 22-23 November 2017 supported by Engineering UK's Tomorrow's Engineers programme.

"I would like to thank you for the excellent Big Bang event and rocket car race at Perth College last week. Our pupils had a fantastic day and thoroughly enjoyed the experience. They have loved being involved in the rocket car competition and were delighted to win an award for best team effort! We will definitely run this as a lunch club again next year. Thanks again." –
St Stephen's High School

Improving the support available to schools

In order to develop and sustain children and young people's interest in STEM, many schools have built effective external partnerships with employers, science centres, festivals and other actors in the STEM field. Local authorities have been active in supporting, developing and promoting these partnerships at a strategic level. However, a recurring issue raised through the consultation was the plethora of STEM school interventions produced by a wide range of external providers that risk causing confusion at school level. In order to ensure the greatest possible impact of these resources, as well as an equitable approach across schools, there is a need to streamline and quality assure the available resources and to make the landscape more navigable for schools.

Through the DYW programme we expect to see school-employer partnerships operating in most secondary schools by the end of 2017-18, and meaningful and productive partnerships operating in all secondary schools by 2018-19. Guidance has been published on establishing and maintaining school-employer partnerships and a national network of industry-led DYW Regional Groups has been established to encourage and support employers to actively engage with education and to recruit more young people. They have an important role to play in the development of school-employer partnerships. The DYW Groups include local authorities as well as employers.

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These groups are playing a key role in broadening young peoples' awareness of STEM careers. Skills Development Scotland has worked with the DYW Regional Groups to develop a simple digital system, *Marketplace*, to facilitate school-employer partnerships. As these partnerships develop there will be more scope for employers to influence curriculum planning to ensure that our young people are learning skills relevant to current and future STEM employment opportunities.

We will support the establishment of effective school-employer partnerships for STEM through the DYW Regional Groups and encourage links between the Groups and STEM Ambassadors, so that by 2020 every school cluster is working with a STEM partner from the private, public or third sectors.

Education Scotland will develop and quality assure an online directory of STEM inspiration activities, covering early learning and all schools. Education Scotland will work with Skills Development Scotland and the DYW Regional Groups to embed the directory within Marketplace. The online directory will be operational in academic year 2018-19.

The directory will help to ensure external STEM inspiration activities address the needs of each sector and are aligned with the STEM self-improvement framework. Education Scotland will work with partners to provide better co-ordination and to establish criteria for quality assuring any school STEM interventions that are funded by the Government so that we support interventions that are proven to work and to encourage employers and others to bring STEM inspiration into early learning and the early years of primary school.

We currently fund the Scottish Council for Development and Industry's network of Young Engineers and Science Clubs to provide STEM inspiration and connection to jobs and careers at a national level. In 2017-18 this funding will support the clubs in more than 1,400 primary and secondary schools and involving more than 30,000 young people. We also support the Generation Science schools outreach programme of workshops and shows, operated by Edinburgh International Science Festival, seen by more than 50,000 young people every year in more than 500 primary schools and nurseries. As a condition of funding, these initiatives will be expected to meet targets on reaching learners in deprived and, or rural areas. They must also demonstrate the steps they are taking to ensure their activities provide opportunities for all learners, whatever their gender. Further, they will be expected, where applicable, to

work with and support practitioners in early years settings on age-appropriate activities to inspire our youngest learners about STEM.

Through our funding of the Young Engineers and Science Clubs and Generation Science in 2017-18, we will continue to support national initiatives that are delivered to schools in every local authority in Scotland, support STEM learning and teaching, offer real-life relevance, and enthuse and inspire young people about STEM.

In addition to these commitments, we believe that further action is required to both maximise the contribution offered by a range of willing partners and ensure this is delivered in a coherent and accessible way in localities across Scotland.

In the consultation paper we said that we would develop a model of collaboration between schools, colleges, universities and employers learning from existing practice, such as the LUMA centres in Finland. The LUMA centres, which are in universities in Finland, seek to inspire and encourage young people to study STEM and pursue STEM careers, and to promote teaching excellence in STEM. They include the development of physical classrooms and laboratories for STEM education and research.

Most of the elements of the LUMA model are already in place in Scotland or will be delivered through this strategy. For example, our Science Centres and Festivals provide STEM inspiration, this strategy seeks to improve STEM professional learning and stimulate excellent STEM teaching and the DYW Regional Groups are fostering school employer partnerships. We recognise, however, that the Finnish LUMA centres have an important role in fostering and developing collaboration for STEM in regions and localities.

In Scotland, through the DYW programme, colleges are increasingly taking a central role in supporting STEM through outreach to schools and developing regional curriculum planning to co-ordinate programmes of learning between schools and colleges. Over the past year, Education Scotland, SSERC and the Energy Skills Partnership (ESP) have been working with colleges and secondary schools to develop opportunities for learners, teachers and college staff to work together on exciting STEM challenges and experiences related to engineering. Twenty college campuses have been involved in these activities which engaged with around one third of Scotland's secondary schools.

Through this activity many schools and young people have become more engaged in STEM. Colleges have also used their contacts with local employers and industry to raise awareness about local STEM careers and we have seen teachers developing stronger partnerships with colleges, learning about new STEM pathways that are available to learners. Given the central role that colleges are playing in developing STEM in their areas they are well-placed to provide a focal point for increased collaboration for STEM in localities.

We now want to expand on the current STEM activity being supported locally, to create a new STEM hub network. The aim of this network will be to:

- raise the profile of STEM with young people, families, communities and adult learners and work with partners to provide a coherent range of activities and programmes to build engagement in STEM and STEM skills at local and regional level;
- facilitate and enable local and regional professional learning discussions and collaboration between schools, colleges and universities (and, in time, early learning providers), working with local authorities; and
- facilitate and enable joint curriculum planning for STEM across schools and colleges locally and regionally, including helping schools develop a curriculum connected to labour market need.

The hubs will aim to work with all sectors including early learning and childcare, primary and secondary practitioners, community learning and development and to provide support to school-based technicians. Our ambition is for the hubs to engage with all school clusters across Scotland by 2022.



£23,500

Full-time first degree leavers average wage of £23,500. £1,000 more than another degree subject from Scottish universities

We will create a STEM hub network to strengthen regional level collaboration between partners, including universities, science centres and employers. The STEM hub network will start to facilitate more joint professional learning activities between secondary schools and colleges in 2018, and this will be broadened out to include primary and early learning settings during 2019.

Delivering up-to-date advice and information on STEM careers

In order to improve the quality and consistency of learning about work and careers in schools, the Careers Education Standard (3-18) is being implemented across Scotland. The Standard aims to broaden horizons, challenge assumptions and stereotypes about learning and career paths and ensure that the choices made by young people are well informed and properly reflect their strengths and interests.

We will work with partners, including DYW Regional Groups, to ensure the Career Education Standard (3-18) is fully implemented by 2020.

In response, Skills Development Scotland has revised its careers advice offer to schools. Contact with Careers Advisers now begins earlier, at the transition from P7 to S1 and continues at every stage of secondary school. This blends a universal offer with targeted support for individuals and includes an invitation for parents to meet and discuss young people's initial subject choices with a Career Adviser in preparation for their move into the Senior Phase. This will help ensure these choices are informed by a sound understanding of the full range of learning and career paths, including STEM, and future labour market trends as well as the benefits to them as individuals. For example, current data shows that average wages for UK domiciled full-time first degree leavers in STEM related subjects from Scottish Universities was £1,000 per annum higher than the all degree subject average.

Starting in 2018, Skills Development Scotland will develop STEM specific labour market information for Skills Development Scotland staff, teachers and other practitioners which describes current demand for STEM skills. This will be accessed through *My World of Work*.

College enrolments in STEM



Increasing responsiveness to the needs of the STEM economy

Our HEIs are ranked amongst the best in the world at what they do. Scotland again has five universities in the world's top 200 according to the Times Higher Education (THE) 2018 rankings. Colleges and universities in Scotland are direct providers of a wide range of higher and further education STEM courses. Our universities are also at the cutting edge of research and innovation across the spectrum of STEM disciplines. Institutions are already taking action to prioritise STEM teaching provision; to capitalise on Scotland's research strengths; and to forge improved links between their education and training offer and changing labour market needs. The Outcome Agreement process, led by the Scottish Funding Council, offers the opportunity to accelerate progress in the STEM courses offered by the tertiary sector in Scotland continuing to evolve to both meet the skills requirements of industry and prepare students for employment.

Each college region will build on existing good practice and partnerships to develop an evolving STEM strategy and action plan to take forward relevant actions from this national strategy. This work will be undertaken in partnership with higher education institutions, key regional and local industries, to drive productivity and growth. SFC will provide guidelines on developing these strategies and action plans, so that, by the end of 2018, a suite of regional statements will be in place to enhance collaborative learning and skills development.

This will make use of the latest Skills Development Scotland data on labour market requirements to shape curriculum and inform the expansion of STEM courses by colleges, where partnership dialogue identifies need. This process will be supported by improved links and collaborative dialogue between tertiary education sector institutions and key industry sectors experiencing a pressing requirement to recruit STEM graduates possessing a range of evolving skills.

Increasing the level of work-based learning within college and university courses offers the opportunity to both continuously improve the curriculum in response to the needs of students and employers, and to provide employers with an energetic workforce eager to share what they are learning. Improving the career pathways between graduates, soon-to-be graduates and STEM employers will increase the likelihood of more young people choosing to pursue a STEM career.

University enrolments in STEM

2010-11	44%
2015-16	49%

Our colleges have made significant strides in high standards of teaching and employer engagement in the sector. To date, seven of Scotland's colleges have obtained STEM Assured status from the STEM Foundation. STEM Assured status provides independent, industry-backed validation of the quality of an institution's science, technology, engineering and mathematics provision. Education providers (schools, colleges, universities) are assessed against a robust framework that benchmarks their capability to design and deliver STEM courses that keep pace with emerging technology and the evolving needs of employers.



Case Study

Forth Valley College

Forth Valley College's creative and collaborative approaches to STEM encourage partners and stakeholders across the Forth Valley region to make best use of their existing expertise and resources to promote and inspire STEM learning beyond the core college curriculum.

The college engages extensively with primary and secondary pupils through STEM clubs and summer schools supported by local employers, initiatives such as the Bloodhound Challenge and Primary Engineers and visits and taster activities, including joint events with employers. A great recent example was the Scottish Power "Challenging the Stereotype" event, promoting careers in engineering and energy to young women (pictured).

The college also works closely with school, university and DYW Regional Group partners to provide STEM related CLPL opportunities for the region's teachers.

Examples include practical workshop skills for technical teachers, safety in microbiology for science teachers and CLPL for Computing and Music Technology teachers. In partnership with the Forth Valley DYW Regional Group the college recently supported an "industry insight" programme of college and employer work placements for teachers.

Lauren Murphy, a Chemistry teacher from Lornshill Academy, undertook placements in the college's Engineering Department and in Hanson Concrete. She said: "I had no idea there were so many different jobs requiring so many different skills within industry. This will definitely enable me to better inform my pupils."

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The Scottish Funding Council are using the Outcome Agreement process to drive, increase and encourage colleges, in partnership with schools, to develop new Senior Phase vocational pathways in STEM-related subjects. Overall, 33.9% of Senior Phase vocational pathways enrolments in 2015-16 were STEM, an increase from 27.6% in 2013-14 and 33.6% in 2014-15.

By the end of 2018 we will conduct an audit of current college and university student placement and graduate and post qualification internship opportunities. Using this baseline, we will increase the number of college and university student placement opportunities with employers within STEM curriculum areas, and increase the number of graduate and post qualification internships offered with STEM employers.

In educating and training young people in the STEM skills required to support improved productivity and inclusive economic growth, it is also important to provide the appropriate advice, information and support that will allow them to take up careers within the STEM sector in Scotland.

We will enhance the focus on STEM careers by college and university careers advice services. This will involve forging closer links between advisory services and STEM industries, in order to best present current and emerging employment opportunities across STEM disciplines. This will be supported by the 15-24 Learner Journey Review, which will provide evidence and views on the approach to careers advice and guidance within colleges and universities, and how this may be enhanced to meet the needs of learners and of STEM sectors of the economy.

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The strategy consultation highlighted the need for greater coherence and connectedness across the range of STEM education and training activity and improved pathways into, between and beyond the Apprenticeship programmes and education and training sectors.

To ensure the relevant skills are available in the labour market of the future, it is essential that the design and development of the Scottish Apprenticeship offer continues to be informed by employer demand and projected skills shortages. This will include taking a data driven approach to establish demand, as well as considering historic and current supply information at sectoral and regional level; reviewing Skills Investment Plans; and engaging with Sector Skills Councils and Industry Leadership Groups.

Skills Development Scotland will take an evidence based approach to link provision of STEM Apprenticeships to the needs of the economy, sectorally and regionally, starting in 2018.

Having access to comprehensive, reliable data is key to ensuring we are able to match the STEM education and training offer to labour market need both now and in the future. The work on aligning skills provision under the Enterprise and Skills Review highlighted the need for Skills Development Scotland and the Scottish Funding Council to work more closely on identifying skills needs and to collaborate more effectively on planning for and commissioning delivery of skills learning and training.

The STEM data study highlighted that significant numbers of people seem not to progress from STEM education, training and study onto jobs and careers in the STEM sectors. The study also suggested that further research is carried out to look at the STEM skills pipeline in detail, to look at the levels of leakage as well as potential double counting (for example, between college enrolments and apprenticeships).

We will build on the STEM data study published alongside this strategy to continue to improve our data and understanding of the STEM skills needed in the labour market, how these are being met by the education, training and lifelong learning system, and how this might be improved, including the identification of barriers for particular groups.

By the end of 2017, we will establish a short-life working group including external experts, and chaired by one of these experts, to analyse and determine the factors that contribute to the loss of people from the STEM skills pipeline and how these can be addressed. As part of this we will, in particular, ask that the group consider how to ensure more STEM graduates consider careers in STEM industries. The group will provide an interim report in Spring 2018 and conclude their work within a year.

We recognise that technology is also impacting the training needs of current employees in many sectors as increasingly digital and automated approaches are changing the nature of work and creating new business and employment opportunities. STEM skills are fundamental to the future success of companies in sectors like advanced manufacturing as we move into a fourth industrial revolution.

Supporting these companies and their employees to drive our future economic growth by improving their productivity is not directly within the scope of this strategy. However, it remains important in building a modern, dynamic and open economy which benefits everyone in Scotland.

We are working with industry to develop initiatives which complement this strategy in addressing the advanced STEM skills needs of current workforces. For example, we are funding CodeClan, Scotland's first industry-led digital skills academy, offering an intensive four-month training programme with direct access to employers and an opportunity to attain a professional developmental qualification at SCQF level 8. We are also establishing a National Manufacturing Institute Scotland as an industry-academia centre of excellence including a skills hub.

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Delivery Arrangements

We will establish an Implementation Group to oversee the delivery of the strategy. The Group will be chaired by the Minister for Further Education, Higher Education and Science. It will develop a delivery plan for the actions identified in this strategy and publish an annual report on progress. It will be supported by a broader external Advisory Group.

The Implementation Group will include membership from the following organisations and bodies with responsibility for delivery:

- Scottish Government – Chair
- Education Scotland and Scottish Qualifications Authority
- Skills Development Scotland, Scottish Funding Council and Enterprise Agencies
- COSLA/ADES and CLD providers
- Science centres/festivals/public science engagement
- Industry, employer and workplace representation
- Third Sector partners including gender, equalities and equity experts

The Group's annual report on progress will include a report on the data that we will collect to measure progress with the strategy. This is set out below. It will also describe what is being done to ensure that all the actions in this strategy promote equality of access, opportunities and outcomes in STEM through equality impact assessment of the strategy as it is delivered. The annual reports will also be provided to other boards and groups overseeing related programmes, including the new Scottish Education Council, the Developing the Young Workforce Programme Board and the new Strategic Skills Board. A key role of the Implementation Group will be to enable and strengthen collaboration, joint working and coherence of action across the different education and training sectors.

The group will also oversee a cross-sectoral project to collate and analyse data on the performance of the education and training system against the aims of the strategy and the development and monitoring of key performance indicators.

An External Advisory and Reference Group will be established to provide advice on implementation and to help provide coherence to the range of STEM activity underway across the education and training landscape. Both the Implementation Group and the External Reference Group will include equality experts, including gender experts, in their respective memberships. Both groups will also include employer representation and there will also be close liaison with the Industry Leadership Groups. The groups will seek to involve learners and practitioners in a meaningful way in their work.

Through its regular reporting and monitoring the Implementation Group will keep the actions set out within the strategy under review, considering where it should be revised or further developed in light of ongoing developments across the education and training sector.

Monitoring Progress

We will monitor progress in delivering this strategy by analysing and collating a range of data about the performance of the education and training system against the aims of the strategy, its outcomes and the changes that we expect to see within the lifetime of the strategy set out in Chapter 5. We will also develop a simple and coherent set of Key Performance Indicators to enable a more precise measurement of progress against the actions. These will be based on the six areas of change that we are working towards, as set out in Chapter 5.

We will work with partners to develop Key Performance Indicators to measure progress against the aims of the strategy. These will be based on the outcomes and the changes we expect to see and the data sources listed in this strategy. They will be finalised by the end of 2017.



In order to measure success against the strategy, we will collect the following data. We will keep this list under review as we develop and adapt this strategy. In particular, we will review it in light of the KPIs that are developed. Where possible we will present the results of our analysis broken down by gender and by other equalities characteristics.

Excellence

- Numbers and geographical distribution of STEM secondary school teachers published in the annual teacher and pupil census (broken down by STEM subject taught and gender).
- Entries and attainment in the STEM related national qualifications, awards and other pathways, including Foundation Apprenticeships.
- Enrolment, achievement and progression in FE and HE STEM subjects.
- Progress by Universities in meeting the targets for teacher training intakes in shortage STEM subjects.
- Engagement by practitioners in STEM professional learning activities.
- Levels of confidence for STEM amongst early learning and primary practitioners.
- Children and young people's attainment and achievement in literacy, numeracy and health and well-being as assessed through the National Improvement Framework, analysed by deprivation and gender.
- PISA scores for mathematics and science.

Equity

- Entries, attainment and achievement in STEM related national qualifications, awards and other pathways, including Foundation Apprenticeships, broken down by region, gender, deprivation and other equalities characteristics that can be measured.
- Enrolment, achievement and progression in FE and HE STEM subjects – segmented by all the relevant protected characteristics and regionally, by individual college and university or across the sector. We will look at Scottish domiciled and non-domiciled students and report on them separately by enrolment, FTE, or success/completion rates.

Inspiration

- Audience participation, numbers and rates and learning outcomes achieved by public science engagement activities funded by the Scottish Government.
- Levels of engagement in STEM related work experience and work inspiration activities offered by employers.
- Levels of practitioner engagement with the Marketplace website to identify STEM activities.
- Attitudes of young people to STEM measured through the Young People in Scotland survey.

Connection

- Number of school-college and school-employer partnerships.
- Young people's progression into positive destinations in STEM including work, training, further training or study.
- Volume of STEM Modern Apprenticeship/Foundation Apprenticeship/Graduate Level Apprenticeship starts and completions.
- STEM skills gaps and shortages in the labour market.
- Employer attitudes towards people leaving education and training and entering employment.

Summary of Actions

Excellence

Aim:

To build the capacity of the education and training system to deliver **excellent** STEM learning so that employers have access to the workforce they need.

Approach:

We will promote **Excellence** by:

- improving the supply of STEM talent into the teaching profession;
- delivering a new, enhanced STEM professional learning package for practitioners, teachers and technicians;
- introducing new measures to improve STEM learning and teaching;
- prioritising STEM in the expansion of apprenticeships; and
- maintaining research excellence in our universities and forging closer links between universities, colleges and industry.

Improving the supply of STEM talent to the teaching profession

We will attract high-quality STEM graduates into teaching through the *Teaching Makes People* recruitment campaign and through the proposed new route into teaching.

*Scottish Government
General Teaching Council
for Scotland*

Starting in August 2018, we will offer bursaries of £20,000 to eligible career changers to allow them to undertake an initial teacher education course and qualify as a teacher in one of the STEM shortage subjects.

Scottish Government

Education Scotland will develop a self-evaluation framework to allow each initial teacher education university to evaluate their Initial Teacher Education programmes including on how their programmes equip new teachers with the skills required to teach numeracy across the curriculum. The framework will be available in time for universities to start this work during academic year 2017-18.

Education Scotland

Delivering enhanced STEM professional learning

Education Scotland will work with partners and, in particular, practitioners, to develop a coherent national approach to STEM professional learning from early 2018. This will include the development of a new national online resource for STEM and an online professional learning offer for early learning practitioners, primary and secondary teachers, technicians and community learning and development practitioners. New opportunities will become available during academic year 2018-19.

Education Scotland

As part of this, Skills Development Scotland will lead work to provide professional learning to help practitioners contextualise STEM learning, from early 2018. This will ensure learners are able to relate their learning and skills to real-life situations, their future careers, and the economy.

*Skills Development Scotland
Education Scotland
Employers*

As part of a wider programme of career long professional learning designed to support the expansion of funded early learning and childcare, we will work with partners and key stakeholders including science centres and science festivals to deliver STEM training that will ensure that ELC practitioners have appropriate skills, knowledge and confidence to deliver STEM learning in ELC settings. This will also form part of the coherent national offer for STEM CLPL set out above.

*Scottish Government
Education Scotland
Local Authorities
Private Nurseries
Science Centres
Third Sector and
Voluntary Organisations*

We will set out plans to enhance opportunities for outdoor learning in STEM in the ELC Quality Action Plan being published in autumn 2017.

Scottish Government

We will provide on-going funding and support for improvements to STEM learning in the classroom through the Scottish Schools Education Research Centre (SSERC), the National Numeracy and Mathematics Hub, the Scottish Attainment Challenge, the Digital Schools programme and the RAISE programme.

*Scottish Government
Education Scotland
SSERC
The Wood Foundation*

We will increase opportunities for STEM related CLPL in colleges and universities by working with the Energy Skills Partnership, College Development Network and the Digital Skills Partnership to ensure college lecturers are provided with high quality skills development within STEM curriculum areas.

*Scottish Funding Council
Energy Skills Partnership
College Development
Network
Digital Skills Partnership*



Improving STEM learning and teaching	
We will work with partners to support the work of the Improvement Collaboratives in their identified priorities for STEM learning, teaching and engagement.	Scottish Government Local Authorities Education Scotland
We will publish the finalised STEM self-evaluation and improvement framework by December 2017 to support ELC settings and schools in the delivery of STEM learning and teaching.	Education Scotland Local Authorities
We will recruit a network of STEM specialist advisors to support learning and teaching in the 3-18 curriculum and raise STEM attainment, with the aim of having a fully operational network by December 2018.	Scottish Government Education Scotland Local Authorities
We will provide dedicated support to digital skills development in early learning settings and schools, including primary schools, through the Digital Schools Programme.	Scottish Government Education Scotland
We will work with local authorities to ensure that excellent spaces for STEM learning are included in new builds and developed through school refurbishment projects. We will make this a key consideration of the Scottish Government's support to any project(s) delivered through any future schools investment programme.	Scottish Government Education Scotland Local Authorities Scottish Futures Trust
Prioritising STEM in the expansion of apprenticeships	
We will prioritise STEM in the expansion of Modern Apprenticeships and the development of Graduate Level Apprenticeships and Foundation Apprenticeships and further improve vocational pathways. This will start in 2018 and continue for the five year lifetime of this strategy.	Skills Development Scotland
Maintaining excellence in STEM research and building links with industry	
Scotland's new Enterprise and Skills Strategic Board will focus the work of all of the enterprise and skills agencies on action to support growth of key economic sectors and to produce the skills that businesses and our people need, especially STEM ones. The Board will seek to improve collaboration on all aspects of STEM education between colleges, universities, wider training programmes and employers to support productivity and growth.	Scottish Funding Council Universities Scottish Enterprise Highlands and Islands Enterprise
Our Innovation Centres will continue to improve the effectiveness and impact of links between businesses and academia, and influence jobs of the future. In particular, Innovation Centres will increase their promotion of STEM and its practical applications to help inspire school pupils and students to develop their STEM skills for a range of careers.	Innovation Centres

Equity

Aim:

To close **equity** gaps in participation and attainment in STEM so that everyone has the opportunity to fulfil their potential and contribute to Scotland's economic prosperity.

Approach:

We will promote **Equity** by:

- introducing new measures to tackle inequity, including gender stereotypes, in STEM learning and careers, from the early years onwards;
- taking targeted action to improve participation in STEM further and higher education courses and apprenticeships; and
- introducing new measures to increase access to public science engagement events by underserved groups, including a focus on audiences in deprived and rural areas.

Tackling inequity in STEM learning and careers

We will work with early learning providers and schools from June 2018 to help them address unconscious bias and gender stereotyping and tackle inequity. This will include the development and delivery of new professional learning programmes on equity in STEM for practitioners. We will seek to embed good practice from the successful Institute of Physics *Improving Gender Balance* project across all schools by 2022. We will create a dedicated resource to lead, manage and support this work and will involve equalities experts in the third sector.

*Education Scotland
Skills Development
Scotland
Third Sector Equality
Partners*

Using information from the Scottish Attainment Challenge we will review the impact and effectiveness of numeracy and STEM related activity to reduce the poverty related attainment gap by March 2019. We will share what we know about effective practice through the National Improvement Hub and wider STEM schools programmes and networks, in order to help inform future decisions on the use of funding in schools.

Education Scotland

Skills Development Scotland will continue to develop its approach to support key influencers (teachers, parents, career advisors and peers) to challenge assumptions of traditional career choices and encourage under-represented groups to take up STEM apprenticeship opportunities. This will include embedding equality considerations in the quality assurance of apprenticeships provision.

*Skills Development
Scotland*

Skills Development Scotland will work with partners at a local level to increase female uptake of Pre-Apprenticeship and Foundation Apprenticeship STEM related programmes, starting in 2018 and continuing until 2022.

*Skills Development
Scotland*

Improving participation in STEM further and higher education courses and apprenticeships

We will launch a new social media campaign in 2018 to increase gender balance in participation in STEM study and to address STEM occupational segregation. This campaign will be led and championed by Scottish Government, Scottish Funding Council and the college and university sectors.

*Scottish Government
Scottish Funding Council
Colleges
Universities*

Each college and university will develop a Gender Action Plan (GAP) through the Outcome Agreement process, with the aim of advancing equity to reduce gender disparities for learners within STEM subject areas. The Scottish Funding Council will produce an inaugural annual progress report on institutional performance in this area in December 2017.

*Scottish Funding Council
Colleges
Universities*

Using the Scottish Funding Council's new school engagement framework which will launch in 2018, and be fully implemented by 2020, we will identify new ways of opening up opportunities in STEM study by breaking down gender barriers and encouraging prospective students from deprived areas.

*Scottish Government
Scottish Funding Council
Colleges
Universities
Local Authorities*

Skills Development Scotland will increase diversity and equity across Scotland's apprenticeship programmes through a targeted package of employer engagement, engagement with under-represented groups and mentoring for young people programmes, starting in early 2018.

*Skills Development
Scotland*

Increasing access to public science engagement events

We will conduct an in-depth analysis of deprivation and rurality to understand how best to reach under-served audiences. This will inform the use of our Public Science Engagement funding in 2018-19 and beyond.

Scottish Government

We will support the Science Centres to continue to target activities at particular groups currently under-served by science engagement activities, through use of our Community Subsidy. This will include close working with communities and other groups to make sure that activities meet their needs whether through events in Centres or delivered through outreach to community venues.

*Scottish Government
Science Centres*

We will require Science Festivals to promote at least one event specifically targeted towards women and girls from 2017-18 onwards as a condition for accepting our funding.

*Scottish Government
Science Festivals*

We will require Science Centres and larger Science Festivals to work the CLD sector to develop Community STEM Plans from 2018-19 onwards as a condition of Scottish Government funding for public engagement activities.

*Scottish Government
Education Scotland
Science Centres
Science Festivals*

Education Scotland will work with the Science Centres and Science Festivals in Edinburgh, Glasgow, Aberdeen and Dundee on a pilot basis to extend the reach of their programmes to parents and families in designated SIMD areas, starting in 2018.

*Education Scotland
Science Centres
Science Festivals*

Inspiration

Aim:

To **inspire** children, young people and adults to study STEM and to continue their studies to obtain more specialist skills.

Approach:

We will promote **Inspiration** by:

- Creating networks of positive STEM role models, mentors and coaches to inspire children, young people and peers to develop their STEM talent;
- Promoting the opportunities and benefits offered by STEM learning and careers including fostering a better understanding of the wider cultural, health and environmental benefits of engaging with STEM and helping learners to make informed choices about STEM study and careers; and
- Recognising and celebrating the successes of learners and providers in developing their STEM capability.

Creating positive STEM role models, mentors and coaches

We will, from June 2018, support ELC settings to promote positive engagement with STEM and tackle gender stereotypes through their parental and family engagement activities.

*Scottish Government
Education Scotland
Local Authorities
Private Nurseries
Third Sector and
Voluntary Organisations
Parent organisations*

We will, from August 2018, extend the resources available for parents through Parentzone and through collaboration with partners, including parent representative organisations and community learning and development partners, support parents and carers in informing and inspiring their children on the opportunities which STEM can offer.

*Education Scotland
Skills Development
Scotland
Parent Organisations*

We will support STEM Ambassadors to engage with sectors which require more support, such as ELC, parents and families, and community learning and development with evidence of increases in this engagement by the end of 2018.

*Scottish Government
Education Scotland
Scottish Schools
Education Research
Centre
Science Centres and
Festivals
CLD Practitioners*

We will use digital platforms and web-conferencing to extend the reach of STEM Ambassadors to ensure all schools and settings have access to the support and resources they can provide with evidence of a broader reach by the end of 2019.

*Scottish Government
Education Scotland
Scottish Schools
Education Research
Centre*

We will establish a new Young STEM Leaders programme to stimulate and strengthen the development of peer mentoring and inspiration in STEM for children and young people by children and young people. The programme will start in early 2018 and be fully operational by 2020.

*Scottish Government
Education Scotland*

Promoting the opportunities and benefits of STEM learning and careers

We will develop a national engagement campaign, in collaboration with the wider science engagement sector, to inspire and engage people of all ages and backgrounds with STEM.

Scottish Government

Skills Development Scotland will build on the success of *MyWoW Live!* by extending provision to reach and inspire more young people into STEM careers including those in more remote and rural locations, starting in 2018.

*Skills Development
Scotland*

We will work with colleges and universities to set out, in their outcome agreements, how higher levels of progression from school to further education, and onward to higher education STEM courses in a college or university setting can be promoted.

*Scottish Government
Scottish Funding Council
Colleges
Universities*

As part of wider awareness raising of all opportunities available in STEM study after school, we will promote the expansion of financial support for taught postgraduate study from 2017-18.

*Scottish Government
Scottish Funding Council
Colleges
Universities*

The Scottish Apprenticeship Advisory Board will provide leadership and support in developing a shared approach to promoting the benefits of a career in STEM to key audiences.

*Scottish Apprenticeship
Advisory Board
Skills Development
Scotland*

Recognising and celebrating success

We will introduce new STEM Awards for ELC settings, schools and CLD settings to promote, recognise and build on activities in these sectors, based on the success of the Digital Schools Award with the first round of awards taking place during academic year 2018-19. We will also explore with partners how the Digital Schools Award may be extended out to early learning and community development settings.

*Education Scotland
Scottish Government*

We will hold an annual learning conference each year of the STEM strategy from 2018-2022 for CLD practitioners. These events will be organised in collaboration with partners and showcase inspirational lifelong learning STEM practice.

Education Scotland

Connection

Aim:

To **connect** the STEM education and training offer with labour market need – both now and in the future – to support improved productivity and inclusive economic growth.

Approach:

We will promote **Connection** by:

- improving and streamlining the support available to schools;
- delivering up-to-date advice and information on STEM careers; and
- increasing the responsiveness of colleges, universities and apprenticeship programmes to the needs of the STEM economy.

Improving the support available to schools

We will support the establishment of effective school/employer partnerships for STEM through the DYW Regional Groups and encourage links between the Groups and STEM Ambassadors, so that by 2020 every school cluster is working with a STEM partner from the private, public or third sectors.

*Scottish Government
DYW Regional Groups*

Education Scotland will develop and quality assure an online directory of STEM inspiration activities, covering early learning, primary and secondary schools. Education Scotland will work with Skills Development Scotland and the DYW Regional Groups to embed the directory within *Marketplace*. The online directory will be operational in academic year 2018-19.

*Education Scotland
Skills Development Scotland
DYW Regional Groups
Local Authorities*

Through our funding of the Young Engineers and Science Clubs and Generation Science in 2017-18, we will continue to support national initiatives that are delivered to schools in every local authority in Scotland, support STEM learning and teaching, offer real-life relevance, and enthuse and inspire young people about STEM.

Scottish Government

We will create a STEM hub network to strengthen regional-level collaboration between partners, including universities, science centres and employers. The STEM hub network will start to facilitate more joint professional learning activities between secondary schools and colleges in 2018 and this will be broadened out to include primary and early learning settings during 2019.

*Scottish Government
Education Scotland
Scottish Funding Council
Colleges
Universities
Local Authorities,*

Delivering up-to-date advice and information on STEM careers

We will work with partners, including DYW Regional Groups, to ensure the Career Education Standard is fully implemented by 2020.

*Scottish Government
Education Scotland
Skills Development Scotland
DYW Regional Groups*

Starting in 2018, Skills Development Scotland will develop STEM specific labour market information for Skills Development Scotland staff, teachers and other practitioners which describes current demand for STEM skills. This will be accessed through My World of Work.

Skills Development Scotland

Increasing responsiveness to the needs of the STEM economy

Each college region will build on existing good practice and partnerships to develop an evolving STEM strategy and action plan to take forward relevant actions from this national strategy, linking industry and the curriculum delivered in the region, to drive productivity and growth. This work will be undertaken in partnership with higher education institutions, key regional and local industries to drive productivity and growth. The Scottish Funding Council will provide guidelines on developing these strategies and action plans, so that, by the end of 2018, a suite of regional statements will be in place to enhance collaborative learning and skills development.

*Scottish Funding Council
Colleges*

By the end of 2018 we will conduct an audit of current college and university student placement and graduate and post-qualification internship opportunities. Using this baseline, we will increase the number of college and university student placement opportunities with employers within STEM curriculum areas, and increase the number of graduate and post-qualification internships offered with STEM employers.

*Scottish Funding Council
Colleges
Universities
Scottish Employer and
Industry Representative
Bodies*

We will enhance the focus on STEM careers by college and university careers advice services. This will involve forging closer links between advisory services and STEM industries, in order to best present current and emerging employment opportunities across STEM disciplines. This will be supported by the 15-24 Learner Journey Review, which will provide evidence and views on the approach to careers advice and guidance within colleges and universities, and how this may be enhanced to meet the needs of learners and of STEM sectors of the economy.

*Scottish Government
Colleges
Universities*

Skills Development Scotland will take an evidence based approach to link provision of STEM apprenticeships to the needs of the economy, in sectors and regions, starting in 2018.

*Skills Development
Scotland*

We will build on the STEM data study published alongside this strategy to continue to improve our data and understanding of what STEM skills are needed in the labour market, how these are being met by the education, training and lifelong learning system and how this might be improved, including the identification of barriers for particular groups.

*Scottish Government
Skills Development
Scotland
Education Scotland
Scottish Funding Council
employers*

By the end of 2017, we will establish a short-life working group including, and chaired by, external experts to analyse and determine the factors that contribute to the loss of people from the STEM skills pipeline and how these can be addressed. As part of this we will, in particular, ask that the group consider how to ensure more STEM graduates consider careers in STEM industries. The group will provide an interim report in Spring 2018 and conclude their work within a year.

*Scottish Government
Skills Development
Scotland
Education Scotland
Scottish Funding Council
Colleges
Universities
Local Authorities
Employers*

Governance and Monitoring Progress

We will establish an Implementation Group to oversee the delivery of the strategy. The Group will be chaired by the Minister for Further Education, Higher Education and Science. It will develop a delivery plan for the actions identified in this strategy and publish an annual report on progress. It will be supported by a broader external advisory group.

Scottish Government

We will work with partners to develop key performance indicators to measure progress against the aims of the strategy. These will be based on the outcomes and the changes we expect to see and the data sources listed in this strategy. These will be finalised by the end of 2017.

Scottish Government

Annex A – Definition of STEM

The separate disciplines of Science, Technology, Engineering and Mathematics can be defined as follows:

- **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, experimentation, exploration and discovery.
- **Engineering** is the method of applying scientific and mathematical knowledge to human activity and **Technology** is what is produced through the application of scientific knowledge to human activity. Together these cover a wide range of fields including business, **computing science**, chemicals, food, textiles, craft, design, engineering, graphics and applied technologies including those relating to construction, transport, the built environment, biomedical, microbiological and food technology.
- All of STEM is underpinned by **Mathematics**, which includes numeracy, and equips us with the skills and approaches we need to interpret and analyse information, simplify and solve problems, assess risk and make informed decisions. Mathematics and numeracy develops essential skills and capabilities for life, participation in society and in all jobs, careers and occupations. As well as providing the foundations for STEM, the study and application of mathematics is a vast and critical discipline in itself with far-reaching implications and value.
- **Digital skills** also play a huge and growing role in society and the economy as well as enabling the other STEM disciplines. Like mathematics, digital skills and digital literacy in particular are essential for participation in society and across the labour market. Digital skills embrace a spectrum of skills in the use and creation of digital material, from basic digital literacy, through data handling and quantitative reasoning, 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. Within digital skills, as noted above, computing science is a separate discipline and subject.



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