

Science, Technology, Engineering & Mathematics: Consultation on a Strategy for Education & Training

Analysis of Responses

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Executive Summary

The Consultation

1. The Scottish Government consulted on a draft strategy for Science, Technology, Engineering and Mathematics (STEM) education and training for Scotland. The draft sets out an approach to STEM education and training that will continue to meet the challenges in ensuring young people gain the STEM skills, knowledge and capabilities they need. The draft strategy is based around two key aims and four priority themes, with specific actions proposed under each of the four themes. The consultation asked 20 substantive questions across various elements of the draft strategy.
2. The final number of submissions received was 192, including 121 from group respondents and 71 from individual members of the public. The group respondents included the education sector, academic and research institutes, science engagement, STEM industry and industry professional/representative bodies, other education and professional/representative bodies, public bodies, and third sector organisations.

Strategy Aims, Outcomes and Scope

3. The consultation document sets out the **definition of STEM** on which the draft strategy is based. A clear majority of respondents agreed with the definition provided, highlighting the extent to which the definition emphasises the importance of digital skills, and of the connectivity between STEM disciplines. A total of 28 respondents objected to the definition of STEM including 4 other STEM education and professional/representative bodies, 3 STEM industry professional/representative bodies and 11 individuals.
4. The draft strategy is based around two **overall aims** (improving STEM enthusiasm, skills, and knowledge; and encouraging uptake of more specialist STEM skills), and four **priority themes** (Excellence, Equity, Connection, and Inspiration). A clear majority of respondents agreed with the aims and priority themes, including reference to consistency with ongoing work across education sectors and industry, and relevance to Scotland's wider economic strategy.
5. A number of respondents expressed reservations and/or suggested amendment to the strategic aims and priority themes. This included concerns that the priority themes are too general to help drive activity; that the strategy could better acknowledge the role of employers in ensuring education and training supports STEM economic sectors; that more emphasis is needed on raising awareness and recognition of STEM beyond those engaging with core STEM disciplines; that the approach must ensure young people see STEM subjects as relevant and "for people like me"; and that the equity theme is broadened beyond deprivation and gender equity to include other disadvantaged groups.

6. The draft strategy sets out **five outcomes as indicators of success** in delivering the strategic aims and priorities. The majority of respondents felt that the success criteria set out in the draft strategy were right, although there remained more than a third who disagreed. Support for the success criteria was most widespread amongst schools and colleges, science engagement and STEM industry respondents. Those in the other STEM education and professional/ representatives, third sector and academic/research respondent groups were most likely to disagree with the success criteria.
7. Respondents raised a range of issues in relation to the success criteria. The most commonly raised issue was the extent to which the success criteria are “SMART”, how progress against the criteria will be measured, and suggestions that meaningful measures of change will require to be developed. Respondents also commented on the extent to which the outcomes focus on the experience and skills of “children and young people”, and some wished to see this extended to include early years engagement and/or improving STEM skills and experience for adults and those returning to STEM. A number of respondents also suggested that criteria should be based on a broader understanding of diversity.
8. The draft provides a specific account of the **scope of the strategy**. A substantial proportion of respondents indicated broad support here, including particular reference to the importance of the early years stage in building enthusiasm for STEM, and the strategy’s recognition of the breadth of experiences and diversity of pathways through STEM education and employment. However, most of those providing comment raised issues for, or suggested some amendment to, the scope of the strategy. These were most commonly related to a stronger role for employers across the strategy.

Current Activity

9. The strategy notes the range of STEM education and training activity currently underway, and sought views on the extent to which current activity will contribute positively to the strategy, and where there may need to be a change in approach.
10. A substantial proportion of respondents gave a generally positive view on the **contribution that current STEM activity will make to the draft strategy**, and few expressed strongly negative views. However, respondents did raise a range of concerns including a lack of coherence and connectivity across STEM education and training activity, and a lack of measurable outcomes and evidence on the effectiveness of current initiatives and approaches. Some also suggested that there is a lack of genuine recognition of and commitment to gender equity across current approaches, and resourcing constraints were highlighted by several respondents including with specific reference to the need for additional resourcing to improve gender and deprivation balance.
11. The majority of respondents highlighted specific areas where they felt that **current approaches could be adapted**. This again included better

coordination of activity to improve impact, ensure fit with skills requirements, and minimise duplication. Respondents also wished to see more and better collaboration across education sectors and with industry in delivery of STEM education and training, and more work around recruitment, development and retention of teachers. .

Implementation and proposed actions

12. The draft strategy set out three **principles for implementation** of the strategy, focused around improving understanding of the fit between STEM skills requirements and education/training activity, simplifying and streamlining activity, and developing meaningful performance measures. A large majority of respondents agreed with these principles. Support was most widespread amongst academic/research institutes, STEM industry and STEM industry professional/representative bodies, and local authority/public body respondents. A total of 28 respondents disagreed with the principles, including some concerns that a clearer statement of approach is required, and that this is linked more explicitly to the strategy's priority themes.
13. Respondents suggested a range of principles and approaches to support implementation of the strategy, and these appeared to reflect a number of common themes. This included the importance of a coordinated approach to maximise impact and minimise duplication; the need to support collaboration across all partners including education sectors, science centres, professional bodies and STEM industries; the importance of a flexible approach to implementation that is able to respond to changes over time; and a stronger focus on equity in STEM education and training.
14. A substantial number of respondents felt that **the strategy is clear and action focused**, and/or that the actions will deliver the intended outcomes. However, respondents also raised concerns or suggested additional actions to ensure successful delivery of the strategy. Common themes here included that the strategy and its actions need to be clearer on how they will be achieved; concern around a perceived over-reliance on enhancement of existing actions; reference to resourcing constraints and suggestions that the extent of financial support for the strategy is what will determine whether the aims and outcomes are achieved; and a need for effective measurement of impact and progress.
15. The majority of respondents felt that the strategy will **improve equity of outcomes**, with support most widespread amongst education sector, academic/research institutes, STEM industry and third sector respondents. However, there remained around a third of respondents who felt that the strategy will not improve equity of outcomes, including a number of science engagement and STEM industry professional/representative respondents. These respondents felt that the strategy should recognise the need to tackle underlying gender inequality and stereotypes to achieve significant progress, and raised concerns that the draft strategy did not propose sufficient new activity. Respondents also highlighted the importance of understanding experience of inequality and disadvantage, and of the approaches that work.

16. The consultation sought views on what specific sectors could do to support the areas for action identified in the draft strategy:
- **Education sectors, voluntary organisations and science engagement providers.** A number of respondents referred to schools as having a central role for the strategy, and views were also generally positive about the role played by science engagement providers. Some suggested that both sectors could have a stronger role in STEM education and training. Respondents also highlighted the value of coordination across sectors, and the potential to use funding structures to encourage and enable collaboration.
 - **Professional bodies and third sector organisations.** Respondents identified a range of areas where the sector could support the strategy, with a focus on teacher training and CPD, and the need for sectoral and regional partnerships to ensure a coordinated and consistent approach. Resourcing was also highlighted by a number of respondents.
 - **Science centres and festivals.** A substantial number of respondents were positive about the work of science centres and festivals in promoting STEM. This included reference to a range of specific activities and initiatives, and some suggestions for national and/or regional coordination of activities.
 - **Other sectors.** Respondents referred to a broad range of sectors and specific bodies as having a contribution to make to the strategy. This included support for a framework for work-based training and development. The role of STEM employers as providers of training and development opportunities was also highlighted.
17. The draft strategy proposed a **National STEM Improvement Framework** to provide early years, schools and clusters with a clear approach to improve STEM learning and teaching. The majority of respondents expressed support for the Framework. However, respondents also raised issues or concerns, with these primarily focused on implementation of the Framework. This included reference to the Framework as “too general” to support detailed implementation. Measurement of performance, and the need to ensure this is meaningful, was also a concern for some.
18. The draft strategy proposed the development of a **model of collaboration** between schools, colleges, universities and employers. The majority of respondents were supportive of the principle of the model. However, respondents also raised a range of broader considerations for the development and implementation of the model. These included the need for the model to be properly resourced; the need to ensure genuine buy-in to the collaborative model; ensuring development of the model draws on existing knowledge and expertise; and a mix of views on the balance between the regional focus of partnerships, and providing a nationally-coordinated approach.
19. The draft strategy included proposals for a **Scottish STEM ambassador network** providing all schools with the opportunity to develop partnerships with

public, private or third sectors. A number of respondents expressed broad support for the proposals, but a range of concerns or points for clarification were also highlighted. This included questions around how proposals relate to multiple existing STEM ambassador programmes, what an additional Scottish network will add, and concerns regarding duplication of effort and the potential to add complexity and confusion. A number of respondents suggested that the objectives for the proposed network could be pursued through existing programmes. Resourcing the expansion of STEM ambassadors across Scotland was also a significant concern for some.

Partnerships

20. Respondents referred to a broad range of **organisations and people that should be involved in delivery** of the strategy. These were most commonly related to STEM industry and industry professional and representative bodies, education sectors and others involved in learning and skills development, academic and research bodies, STEM and wider science engagement organisations, third sector bodies including those with a focus on equalities, public sector organisations including funding bodies, and young people and parents.
21. Respondents also detailed a **range of activities they are current undertaking** that support the strategy's aims and priorities. These were typically focused around areas such as supporting STEM learning and teaching; partnership working; STEM engagement; vocational pathways and working with the STEM industry; and actions with a specific focus on equality.
22. Respondents referred to a wide range of approaches that **employers could use to improve the diversity of their STEM talent**. These included raising awareness of and engagement in STEM industries; increasing employer engagement with education sectors and other partners; expanding participation in apprenticeship programmes and workplace experience; and ensuring recruitment approaches reach those from disadvantaged backgrounds, and are aware of and responsive to disadvantage. Respondents also referred to a need for changes to STEM workplaces to provide a more flexible, inclusive and family-friendly culture. This reflected some concerns around the number of employees lost to the STEM sector due to poor working conditions, poor training and a lack of opportunities for progression.

Introduction

This report presents an overview of findings from an analysis of responses to the Scottish Government's consultation on development of a strategy for Science, Technology, Engineering & Mathematics (STEM) education and training.

The Consultation

The Scottish Government consulted on a draft strategy for STEM education and training for Scotland. As the draft strategy highlights, STEM skills and capacities have a significant role to play in fulfilling the Scottish Government's Purpose for Scotland as a more successful and fairer country with opportunities for all, and demand for these skills and capabilities is increasing across Scotland's economy. While there is a range of action being taken to improve STEM education and training, a series of research reports and working groups have highlighted challenges in ensuring young people gain the STEM skills, knowledge and capabilities they need.

The draft strategy sets out an approach to STEM education and training which will continue to meet these challenges. This approach is based around two key aims (improving STEM enthusiasm, skills, and knowledge to raise attainment and aspirations; and encouraging uptake of more specialist STEM skills for employment in STEM economic sectors), and four priority themes to deliver these aims (Excellence, Equity, Connection, and Inspiration). The draft strategy also sets out specific proposed actions under each of the four themes, and a range of cross-cutting actions which will inform implementation of the strategy.

The consultation asked 20 substantive questions across various elements of the draft strategy. Respondents were invited to give their views on the definition of STEM on which the draft strategy is based, the strategy's scope and overall aims and priorities, on the extent to which the strategy is supported by current ongoing activity, and on the specific actions proposed. Five of the questions included a 'closed' yes/no element, and all had an open element inviting written comment. The consultation period ran from 8 November 2016 to 31 January 2017.

The Scottish Government also organised a series of five discussion events during the consultation period. Events were attended by stakeholders across all sectors, some of whom went on to submit a formal response to the consultation. Findings from the events have been integrated with consultation responses for the purposes of this report.

Overview of written submissions

The final number of submissions received was 192. Of these, 121 were submitted by group respondents (63% of all respondents) and 71 by individual members of the public (including some who referred to experience of working in the education, research and/or STEM sectors). A profile of respondents by type is set out in the table below.

Profile of Respondents by Type

Respondent Type	
Education sector - Colleges	10
Education sector - Universities	11
Education sector - Schools/Other	6
Academic/Research Institute	5
Science engagement	12
STEM industry	14
STEM industry professional & representative bodies	17
Other STEM education, professional & representative bodies	10
Other professional & representative bodies	12
Local authorities and other public bodies	9
Third sector/Non-profit organisations	15
	<i>Groups (Total)</i>
	121
Individuals	71
TOTAL	192

Twelve broad respondent types have been used for the main analysis (eleven categories for group respondents, and one for individuals). A full list of group respondents is provided as an Annex to this report, and the main points to note about the composition of the groups are:

- **Education sector** accounted for a total of 27 respondents across schools, college and university sectors. This included a small number of private sector education and training providers;
- **Academic or Research Institutes** accounted for 5 respondents, with three of these having a specific STEM-related focus. As noted above, a number of individual respondents also appeared to have links with or experience of the academic sector;
- **Science engagement** accounted for 12 respondents including science centres, science festivals, museums, and third sector organisations with a focus on science engagement and STEM;
- **STEM industry** accounted for 14 responses across a range of industry sectors, and including some with a specific digital focus. As noted above, a number of individual respondents also appeared to have experience in the STEM private sector;

- **STEM industry professional & representative bodies** accounted for 17 respondents including representative organisations across the STEM sectors;
- **Other STEM education, professional & representative bodies** accounted for 10 respondents, most with a specific focus on STEM skills and education/training. This includes a mix of representative and professional bodies, and partnerships across education sectors and the STEM industry;
- **Other professional & representative bodies** accounted for 12 respondents, and includes a mix of public bodies and professional or representative organisations who do not have a specific focus on STEM;
- **Local authorities and other public bodies** accounted for 9 respondents, including six Scottish local authorities and three other public bodies; and
- **Third sector/Non-profit organisations** accounted for 15 respondents. This grouping incorporated a mix of organisation types including some with a specific education focus, membership organisations and campaign or equality groups.

Consistent with the diversity of respondents to the consultation, most responses considered the full range of STEM disciplines, although the importance of mathematics and digital skills was a theme for some respondents. Similarly, the strong response to each of the 20 consultation questions makes clear that respondents considered all parts of the draft strategy. There was some variation in specific focus across responses, for example reflecting respondents' anticipated role in delivering the strategy, or the extent to which questions focused on specific sectors. However, the majority of respondents provided a view across all consultation questions.

Across these responses, it is notable that resourcing emerged as a significant theme for many respondents. This included for example in relation to views on the strategy's outcomes (and the extent to which existing resources can support these), and on approaches to implementation of the strategy. We highlight the specific points made in relation to resourcing throughout the report, but it was clear that concerns around resourcing shaped a number of the responses.

Structure of the report

The remainder of this report presents a question-by-question analysis of submissions. Each section provides an overview of key points from the relevant section of the draft strategy, presents the results of any "closed" Yes/No questions by respondent group, and provides a summary of written responses for each question. This analysis considers respondents' views on the content set out in the draft strategy, including any issues or concerns raised. The report also summarises any suggestions from respondents in relation to additional aims, priorities or actions for the strategy.

It should be noted that the purpose of the report is to reflect the balance and range of views expressed through the consultation. It does not seek to provide any policy recommendations.

Strategy Aims, Outcomes and Scope

The first sections of the consultation document summarise the context to the draft strategy, provides the definition of STEM which underpins the strategy, and sets out the aims and priorities and outcomes around which the strategy will be structured. The document includes a series of four consultation questions focused on:

- The definition of STEM set out in the draft strategy;
- The key aims and priorities on which the strategy will be based;
- The outcomes which will be used to measure success; and
- The scope of the strategy.

Definition of STEM

The consultation document sets out the definition of Science, Technology, Engineering and Mathematics (STEM) on which the draft strategy is based. The definition makes clear that STEM, and STEM education and training, is about developing expertise in each field, but also developing the ability to work across disciplines. In relation to each of the four STEM elements, and digital skills, the draft strategy is based on the following definition:

Science enables us to develop our interest in, and understanding of, the living, material and physical world and develop the skills of collaboration, research, critical enquiry and experimentation.

Technologies cover a range of fields which involve the application of knowledge and skills to extend human capabilities and to help satisfy human needs and wants, operating at the interface of science and society. This covers business, computing science, chemicals, food, textiles, craft, design, engineering, graphics and applied technologies.

Engineering a specific branch of the technologies, draws on scientific methods and knowledge to address and solve real-world problems.

All of STEM is underpinned by **Mathematics**, which includes numeracy, and equips us with the skills we need to interpret and analyse information, simplify and solve problems, assess risk and make informed decisions.

Similarly, **digital skills** play a huge and growing role in society and the economy and enable the other STEM disciplines. Digital skills embrace a spectrum of skills in the use and creation of digital material, from basic digital literacy, through problem solving and computational thinking to the application of more specialist computing science knowledge and skills that are needed in data science, cyber security and coding.

The first consultation question sought respondents views on the definition set out on the previous page.

Q1. Do you agree with the definition provided of STEM for the purposes of this Strategy?

A total of 165 (of 192) respondents answered Question 1. A clear majority, 83% of those answering the question, agreed with the definition provided. However, there was some variation across respondent types in the level of support for the definition of STEM. Support was most widespread amongst schools and colleges, science engagement and STEM industry respondents – all STEM industry respondents agreed with the definition. A total of 28 respondents, 17% of those answering, disagreed with the definition of STEM. This included 17 group respondents (including 4 other STEM education and professional/representative bodies and 3 STEM industry professional and representative bodies) and 11 individuals.

Question 1: Response by Respondent Type

Do you agree with the definition provided of STEM for the purposes of this Strategy?	Yes	No	No answer	Total
Education sector - Colleges	9	1		10
Education sector - Universities	5	2	4	11
Education sector - Schools/Other	5	1		6
Academic/Research Institute	4	1		5
Science engagement	10	2		12
STEM industry	14			14
STEM industry professional & representative bodies	12	3	2	17
Other STEM education, professional & representative bodies	2	4	4	10
Other professional & representative bodies	4		8	12
Local authorities and other public bodies	7	1	1	9
Third sector/Non-profit organisations	11	2	2	15
<i>Groups (Total)</i>	83	17	21	121
Individuals	54	11	6	71
TOTAL	137	28	27	192
Percentage of those answering	83%	17%	-	100%
Percentage of all respondents	71%	15%	14%	100%

A total of 107 respondents provided further comment at Question 1, 56% of all respondents. While most of those providing written comment agreed with the proposed definition of STEM (70 of the 107 providing comment supported the definition), it is notable that nearly all of those answering 'no' at Question 1 provided further comment, as did a number who had not answered the yes/no question.

A number of respondents used written comments to re-iterate their support for the definition of STEM set out in the draft strategy. This included reference to specific aspects of STEM and the definition which respondents particularly welcomed:

- The most commonly mentioned aspect of the definition was reference to digital skills and their importance across the STEM disciplines, and for specific fields such as Computer Science. A mix of respondents including colleges and universities, STEM industry, other STEM education/professional bodies and local authorities made specific reference to the importance of digital skills.
- Several respondents also supported reference to the interconnectedness of the four main STEM disciplines. This included reference to the interdisciplinary skills that apply across the four disciplines (and other parts of the curriculum), such as the fundamental role of mathematics. Again this was highlighted by a cross-section of respondents including colleges, professional/representative bodies, and academic & research institutes.
- A small number of respondents made specific reference to the definition highlighting the importance of STEM subjects and skills across the wider curriculum, and beyond education for society and the economy.

The majority of those who supported the definition of STEM and who provided written comment at Question 1 raised issues or suggestions for amendment. This included potential amendments to the definition of each of the STEM disciplines, and a number of broader points which they wished to see better represented in the definition.

In relation to the definition of **Science**, a small number of other STEM education and professional/representative bodies suggested that excluding reference to the role of science in solving “real world problems” (as referenced in the definition of engineering) may give the impression that science is focused only on theoretical issues. A small number of respondents also wished to see explicit reference to the role of exploration and discovery in the definition of science – this reflects a wider view discussed later in this section that creativity should feature more prominently in the definition of STEM.

Respondents raised a range of points in relation to the definition of **Technology**. The most common related to examples provided within the definition of specific fields within technology. Several respondents suggested additional fields to be added to the definition – including construction/building technologies, transport, energy, biomedical or microbiological, and food technology. In contrast, one other STEM education and professional/representative body suggested that the definition

is simplified to remove reference to specific elements of technology, and a university questioned the inclusion of textiles, craft and design within the definition. A small number of respondents also wished to see consistent use of the term “technology” or “technologies” throughout the strategy.

In relation to the definition of **Engineering**, the most common issue raised by respondents was around the reference to engineering as a “branch of the technologies”. Several respondents (including universities, science engagement and STEM industry) suggested that the definition should include a clearer recognition that engineering is a distinct field. This included a suggestion that engineering may be an important area for engagement in STEM for many young people. A small number of respondents also wished to see specific aspects of engineering given a more prominent role in the definition – including the built environment, construction and transport, and capabilities such as mathematics and design. Finally in relation to engineering, a small number of respondents raised concerns that reference to “real world problems” could imply that engineering is the only STEM discipline concerned with the “real world”.

A small number of respondents raised concerns around the definition of **Mathematics**. As noted above, a number of respondents welcomed the emphasis on the role of mathematics across the other STEM disciplines. Another STEM education and professional/representative body also suggested that the definition of mathematics should not be framed exclusively in the context of other STEM disciplines, but should also recognise the wider role of maths (e.g. for economics and finance). A university respondent also wished to see specific reference to statistics as a distinct field.

As noted above, several respondents specifically welcomed reference to **Digital Skills** within the definition of STEM. However, some suggested modifications or extension to the representation of Digital Skills within the definition. This was most commonly related to a wish to see a clearer distinction between digital skills as capabilities needed across all STEM subjects, and Computer Science as a distinct discipline. Several respondents raised concerns that the draft strategy does not make sufficiently clear the distinction between “digital skills”, “computer science” and “ICT”. A small number of respondents also wished to see a more prominent role for digital skills across each of the STEM disciplines, including suggestions for “STEMD” as an alternative acronym. An other professional & representative body suggested that the definition of Digital Skills should make clearer that these skills include a specific focus on dealing with data and quantitative reasoning, over and above basic digital literacy. An other STEM education and professional/representative body also wished to see recognition of the need for flexibility in Digital Skills to adapt to rapidly changing technologies. Finally, a small number of respondents questioned whether the inclusion of Digital Skills as part of the definition of STEM may “water down” the focus on the core STEM disciplines, or saw digital skills as part of technology rather than as a separate discipline.

In addition to the above points on the five elements of the definition set out in the draft strategy, respondents also raised a range of broader points, including cross-

cutting themes which some felt should be better represented by the definition of STEM. The key points are summarised below:

- The most commonly raised issue was that the definition could give greater recognition to the importance of creativity and arts for STEM. A cross-section of respondents made reference to the role of arts and creativity in supporting creative thinking, experimentation and innovation across STEM subjects, and in developing new ideas and products. Some suggested that the growing use of alternative acronyms such as “STEAM” reflected this.
- Several comments were concerned with the balance between presenting STEM as a coherent entity, and providing an account of each of the four distinct disciplines. A small number of respondents raised concerns that the definition (and the strategy as a whole) should be clearer that STEM is not a single entity but rather a framework for four distinct disciplines. However, others felt that the definition required a stronger recognition of the connections between the main STEM disciplines, including for example the importance of mathematics across other disciplines. This included potential concerns that the strategy should not lead to the STEM subjects being approached or promoted in isolation.
- A small number of college and science engagement respondents wished to see a clearer statement on how Computer Science fits within the definition of STEM.
- Several respondents wished to see the definition of STEM focus on “STEM capabilities” or “STEM skills” to represent the wider set of skills and abilities which are important beyond the core STEM subjects. This included a suggestion that a focus on STEM and digital skills (rather than distinct STEM subjects) may better reflect the growing emphasis on these skills across disciplines. A third sector/non-profit respondent also suggested that the definition should acknowledge the different “levels” of STEM skills – the basic skills such as numeracy, digital literacy and science literacy that are required by all, and more specialist STEM skills required to support the STEM economy.
- A small number of respondents raised concerns that some of the language used to define the STEM disciplines may not be consistent with the current curriculum, and that consistency with other definitions of STEM (for example as used by the Scottish Funding Council and Higher Education Statistics Authority) should also be ensured.

The 28 respondents who objected to the definition of STEM and who provided written comment also raised a range of issues or suggestions for amendment. It is notable that there was significant overlap in the points highlighted by these respondents, and those raised by respondents who supported the definition of STEM (as summarised over the previous pages). Below we summarise the key points raised by those who objected to the definition of STEM:

- In relation to the definition of **Science**, respondents suggested a need for explicit reference to the role of experimentation and discovery in the definition of science, and this appeared to be linked to a wider view that the strategy should present science as an attractive and accessible area. A small number were also concerned that the definition of science focuses on “interest and understanding”, rather than the importance of the scientific method for producing and testing ideas.
- In relation to the definition of **Technology**, a small number of respondents suggested additional fields to be added to the definition – including construction, transport, and biotechnologies.
- In relation to the definition of **Engineering**, the most common issue was that the definition does not adequately describe the scope of the discipline, with some objecting to the description of engineering as a “branch of the technologies”. Several respondents suggested that the definition should include a clearer recognition that engineering is a distinct field, and suggested that it would be more accurate to describe technology as the product of engineering activity. An other STEM education and professional/representative body suggested alternatives to the definition of engineering, with reference to existing definitions used by professional bodies within the field.
- In relation to the definition of **Digital Skills**, several respondents again raised concerns that “digital skills”, “computer science” and “ICT” appear to be used interchangeably throughout the strategy. It was also suggested that Computer Science should be distinct from digital skills within the definition, for example included under science or engineering. A small number of respondents also wished to see a clearer statement on the level of digital skills required, and suggested that these more advanced “data skills” could be included more explicitly in definition of each of the STEM disciplines, with digital skills focusing on more general digital capabilities.
- Respondents also referred to **broader issues and concerns** relating to the definition of STEM. This included clearer links between STEM and the wider curriculum (for example the importance of literacy skills across STEM disciplines), and greater recognition for the potential role of STEM and STEM skills across a wider range of curriculum areas and employment opportunities. A small number of respondents also suggested that the definition should highlight the skills and competencies required across STEM, rather than focusing on specific subject knowledge. This included suggestions that the definition of STEM excludes skills around creativity and innovation.

Aims and priorities

The draft strategy is based around two overall aims, and four priority themes identified to deliver those aims. These aims and priorities are summarised below:

- The **two key aims** are (i) to improve levels of STEM enthusiasm, skills, and knowledge in order to raise attainment and aspirations in learning, life and work; and (ii) to encourage uptake of more specialist STEM skills required to gain employment in the growing STEM sectors of the economy, through further study and training.
- The **four priority themes** are Excellence, Equity, Inspiration, and Connection.

The second consultation question sought respondents views on these aims and priority themes.

Q2. Do you think the aims of this Strategy and the four priority themes are the right ones to address the challenges identified?

A total of 165 (of 192) respondents answered Question 2. A clear majority, 84% of those answering the question, agreed with the aims and priority themes. However, there was some variation across respondent types in views on the strategy aims and priorities. Support was most widespread amongst schools and colleges, science engagement, STEM industry and local authority/public body respondents. Indeed all schools, college, science engagement and third sector respondents supported the strategy aims and priority themes.

A total of 26 respondents, 16% of those answering, disagreed with the aims and priority themes. This included 9 group respondents (the largest groups being 3 universities, 2 STEM industry professional/representative bodies, and 2 other STEM education and professional/ representative bodies) and 17 individuals.

Question 2: Response by Respondent Type

Do you think the aims of this Strategy and the four priority themes are the right ones to address the challenges identified?	Yes	No	No answer	Total
Education sector - Colleges	10			10
Education sector - Universities	5	3	3	11
Education sector - Schools/Other	6			6
Academic/Research Institute	3	1	1	5
Science engagement	12			12
STEM industry	13		1	14
STEM industry professional & representative bodies	13	2	2	17
Other STEM education, professional & representative bodies	6	2	2	10
Other professional & representative bodies	5	1	6	12
Local authorities and other public bodies	8		1	9
Third sector/Non-profit organisations	12		3	15
<i>Groups (Total)</i>	93	9	19	121
Individuals	46	17	8	71
TOTAL	139	26	27	192
Percentage of those answering	84%	16%	-	100%
Percentage of all respondents	72%	14%	14%	100%

A total of 127 respondents provided further comment at Question 2, 66% of all respondents. Most of those providing written comment agreed with the aims and priority themes (89 of the 127 providing comment), but it is notable that nearly all of those answering 'no' at Question 2 provided further comment, as did a number who had not answered the yes/no question.

A number of respondents used written comments to re-state their support for the strategy aims and priority themes. This included reference to specific aspects of the aims and priority themes which respondents felt were particularly positive:

- Several respondents noted the consistency between the aims and priority themes, and ongoing work across education sectors and industry in relation to STEM education and training. Some also referred to the relevance of the strategy aims – and particularly uptake of specialist STEM skills – to Scotland's wider economic strategy.

- In terms of specific themes, several respondents referred to the importance of “challenging perceptions” as highlighted by the draft strategy, and placed particular emphasis on the inspiration theme in terms of encouraging greater uptake of STEM skills. A small number of respondents also highlighted the theme of equity, including some who saw improving equity in engagement with STEM as the key priority for the strategy.

A number of respondents also suggested that the approach to delivery of the aims and priorities will be key. This included suggestions that the high level aims and priorities do not mark a clear change from previous initiatives to increase STEM participation, and that it will be the specific actions (and funding) to take the aims and priorities forward that determine the strategy’s success. Respondents’ specific views on actions to deliver the strategic aims and priorities are considered in later sections of the report.

Most of those providing written comment at Question 2 raised issues, points for clarification, or suggestions for amendment. These are summarised over the following pages.

Views on strategic aims

Respondents expressed a range of views in relation to the two aims set out in the draft strategy, and it is notable that the issues raised were broadly similar across those who answered “yes” or “no” at Question 2. Below we summarise the key points raised in relation to each of the aims in turn.

The first strategic aim is focused on **improving levels of STEM enthusiasm, skills, and knowledge**. This highlights the role of improved STEM skills and knowledge in raising attainment and aspirations throughout learning, life and work. Respondents were broadly supportive of the importance of improving enthusiasm, skills and knowledge. However, a small number of respondents raised specific points in relation to this aim:

- A university respondent suggested that the aim should make clearer the need to change perceptions and increase enthusiasm across society as a whole – from parents, teachers and head teachers, local authorities and government. This was also reflected in comments from a third sector respondent that the aim should recognise the importance of STEM skills and knowledge for the everyday lives of young people and adults.
- A college respondent suggested that the strategy places greater emphasis on lifelong learning.

The second strategic aim seeks to **encourage uptake of more specialist STEM skills through study and training**, recognising the importance of these skills for employment in the growing STEM sectors of the economy. Again, respondents were broadly supportive of this aim. However, a small number of respondents (primarily colleges) suggested that the aim should better reflect the need to ensure STEM education and training continues to meet the needs of employers, and that there is stronger engagement with employers across all education and training

sectors. In this context, respondents also suggested that the aim is clearer on the types of skills required – including for example problem solving, analytical and reasoning skills, higher order mathematics skills, computational and data analysis skills.

In addition to comments on each of the strategic aims, respondents also raised a range of broader points. This included views on how the strategic aims are framed, and themes or issues which some felt should be better represented. The key points are summarised below:

- Several respondents (primarily STEM-related and other education and professional/ representative bodies) suggested that the focus on employment and the economy as key drivers of demand for STEM skills should not be at the expense of recognising the intrinsic value of STEM subjects, and their wider social and cultural relevance. This included reference to connections between the strategy and Scotland’s wider social, economic and environmental strategies. Some also suggested an additional aim which emphasised the social and cultural importance of STEM, and/or focused on raising awareness and understanding of STEM across the population as a whole.
- A small number of respondents also suggested that the strategic aims should recognise the relevance of STEM subjects and skills across other parts of the curriculum, and the importance of breaking down the current division between STEM and other parts of the curriculum to reach a broader range of young people.
- A small number of respondents expressed concerns that the phrasing of the strategic aims may encourage those involved in delivery of the strategy to think of “inspiration and enthusiasm” and “specialist STEM skills” as distinct areas. These respondents suggested that experience indicates that young people and adults are most likely to develop enthusiasm for STEM (and acquire STEM skills) through discovering their benefits through direct experience - for example, as opposed to being persuaded of the relevance of STEM skills.
- Respondents also referred to additional themes that they felt should be better represented by the strategic aims – whether this is within the two proposed aims, or as additional aims:
 - A stronger role for equity as a central element of the strategy, in addition to representation as a priority theme.
 - Stronger emphasis on making STEM relevant to young people’s subject and career decisions.
 - Ensuring strong and cohesive partnerships across stakeholders, and reflecting the importance of these partnerships to achieving real change.

- Giving a commitment to the sustainability of the strategy.
- Aims that specifically address the challenges of “developing coherence” and “building partnerships” as highlighted in the draft strategy.

Views on priority themes

Consistent with comments on strategic aims, respondents made a broad range of points in relation to the priority themes. This included comments specific to each of the four themes, and views on other issues or themes that should be better represented. Below we summarise the key points raised by respondents in relation to each of the themes in turn.

The **Excellence** theme is focused on raising the level of STEM skills and knowledge throughout education, lifelong learning, and training. Relatively few respondents commented specifically on this theme. Specific points made by respondents included suggestions that the strategy makes clear that excellence is relevant to learning and training across formal and informal settings, and highlights the importance of literacy and communication alongside the current reference to numeracy and digital skills. An other STEM education and professional/representative body also suggested that raising standards of STEM skills and knowledge should be the key benchmark of success for the strategy.

The **Equity** theme is concerned with action to reduce equity gaps, including particular reference to deprivation and gender. Respondents were broadly supportive of this theme, with comments typically focusing on how the theme can be extended or better implemented:

- Several respondents suggested that the theme of equity is broadened beyond deprivation and gender equity (as referenced in the draft strategy) to include other disadvantaged groups. Indeed, a small number of respondents suggested that the focus on deprivation and gender could be read as excluding or relegating the status of other protected characteristic groups. Respondents also referred to other forms of disadvantage and population groups which should be emphasized under the equity theme. This included rurality and geographical disadvantage, expanding reference to care leavers to include looked after children, and including ethnic minorities.
- A third sector respondent also suggested that the equity theme should recognise that real change in equity within STEM requires a wider focus on tackling inequality throughout individual’s lives.
- A small number of respondents suggested specific issues in relation to equity. These included noting that inequality is more significant for some STEM disciplines, that young people need access to high quality information and advice, and the need to provide young people with better insight into the range of careers across STEM industries.

The **Inspiration** theme is focused on ensuring young people and adults are enthused and inspired to study STEM – and continue to do so to develop more specialised skills. Comments again indicated broad support for the theme, including a schools/other respondent suggesting that this should be the top priority. The key points raised by respondents focused on:

- The importance of not just inspiring young people and adults, but also raising aspirations by ensuring young people see STEM subjects as relevant and “for people like me”. Several respondents also highlighted the importance of increasing confidence and awareness in STEM across communities – including key figures such as parents and teachers.
- The importance of building individuals’ confidence, alongside inspiring and changing aspirations.

The **Connection** theme is focused on matching STEM education and training to the needs of the labour market – currently and in the future. Comments were generally supportive of the theme, with the main issues raised by respondents seeking to extend the reach of the theme:

- A number of respondents across respondent types suggested that the connection theme could better acknowledge the connections between STEM skills and other economic sectors, and the relevance of STEM for everyday life. Several respondents suggested that this was important in raising awareness and recognition of STEM beyond those engaging with core STEM disciplines. This included reference to positive outcomes for health and environment associated with public engagement in STEM.
- A small number of respondents suggested that the theme should recognise that connection with the labour market requires a breadth of curriculum, interdisciplinary learning and transferable skills to ensure education and training remain relevant to what are likely to be changing labour market needs.
- A STEM industry respondent suggested that the role of STEM organisations in inspiring young people and adults should be emphasised in the context of these organisations being the future beneficiaries of young people and adults with STEM skills.

In addition to the points outlined above in relation to each of the priority themes, a substantial number of respondents highlighted other issues and themes which they felt should be better represented by the strategic principles. This included cross-cutting issues that applied to all four themes, and suggestions for additional themes:

- A number of respondents, including a mix of respondent types, highlighted the potential for confusion regarding the relationship between the four Economic Strategy priorities summarised at page 5, and the four strategic priorities at page 7. Indeed some addressed their response to Question 2 to the Economic Strategy priorities, in addition to the priority themes.

- Several respondents suggested that the priorities are very general and “difficult to disagree with”, but are too general to be helpful for a STEM strategy.
- Some suggested that there should be greater emphasis across the priority themes on understanding and applied skills - for example, over and above acquiring knowledge. Transferable skills and understanding such as mathematics and data skills were seen as particularly relevant given the focus on economic growth, and difficulties in predicting likely future skills requirements. This included some who suggested that better evidence was required on current labour market needs, and potential developments that may change those needs.
- A small number of respondents suggested that the strategy highlights the importance of local and regional approaches, and is clear that there is no “one size fits all” approach.
- Several respondents highlighted the importance of strategic priorities being measurable, and raised concerns around how progress will be measured in relation to the priorities set out in the draft strategy. This included some of those who disagreed with the aims and priorities at Question 2.
- A small number of respondents made specific reference to resourcing as a significant challenge to achieving the strategic aims and priorities – and suggested that this should be better addressed in the strategy.
- Respondents raised a range of other themes or issues which they felt should be represented in the strategy priorities – whether across the proposed four priorities, or as additional priorities. This included:
 - Sustainability;
 - Accessibility, and provision of education and training in the context of rurality and physical connectivity;
 - The importance of literacy and communication, alongside the current reference to numeracy and digital skills;
 - Transferability of STEM skills (particularly in the context of navigating multiple career options, and changing economic conditions);
 - The role of STEM subjects and skills in driving productivity growth across the economy as a whole; and
 - Ensuring young people, parents, teachers and the industry are better informed.

Outcomes and success criteria

The draft strategy set out five outcomes as indicators of success in delivering the strategic aims and priorities. These outcomes are summarised below:

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

Question 3 sought respondents views on these outcomes/success criteria.

Q3. Are these success criteria right? If not, tell us what criteria we should use instead.

A total of 156 (of 192) respondents answered Question 3. Around 3 in 5 of those answering the question (63%) felt that the success criteria set out in the draft strategy were right, indicating somewhat more divided views than was evident in relation to Questions 1 and 2. However, there was some variation across respondent types. Support for the success criteria was most widespread amongst schools and colleges, science engagement and STEM industry – although there remained respondents across most of these groups who disagreed with the success criteria.

A total of 58 respondents, 37% of those answering, disagreed with the success criteria. This included 35 group respondents and 23 individuals. In relation to group respondents, those in the other STEM education and professional/representatives, third sector and academic/research institutes were most likely to disagree with the success criteria.

Question 3: Response by Respondent Type

Are these success criteria right?	Yes	No	No answer	Total
Education sector - Colleges	7	3		10
Education sector - Universities	2	4	5	11
Education sector - Schools/Other	5		1	6
Academic/Research Institute	2	2	1	5
Science engagement	9	2	1	12
STEM industry	11	2	1	14
STEM industry professional & representative bodies	10	2	5	17
Other STEM education, professional & representative bodies	3	6	1	10
Other professional & representative bodies	2	4	6	12
Local authorities and other public bodies	5	2	2	9
Third sector/Non-profit organisations	3	8	4	15
<i>Groups (Total)</i>	59	35	27	121
Individuals	39	23	9	71
TOTAL	98	58	36	192
Percentage of those answering	63%	37%	-	100%
Percentage of all respondents	51%	30%	19%	100%

A total of 137 respondents provided further comment at Question 3, 71% of all respondents. These were split between those who agreed with the success criteria (59 providing comment) and those who disagreed (58 providing comment). A number of those who had not answered the yes/no question also provided comment. It is notable that all of those answering 'no' at Question 2 provided written comment, compared to around 3 in 5 of those who supported the success criteria.

Nearly all of those providing comment raised points for clarification, issues or suggested changes to the outcomes/success criteria. There was significant overlap in the issues raised by those who supported the success criteria and those who were opposed – suggesting that the motivations for those disagreeing with the criteria were also recognised as issues by a substantial number of those who broadly supported the criteria. Reflecting this, over the following pages we provide a summary of the range of points raised by both groups.

Views on specific success criteria

While comments suggest broad support for the five success criteria set out in the draft strategy, respondents raised a range of issues in relation to these specific criteria. Here we summarise the key points raised in relation to each of the criteria in turn.

Outcome 1 is focused on ensuring **all children and young people experience relevant and engaging STEM learning across all STEM disciplines**. While a large number of those providing comment recognised the importance of STEM learning being relevant and engaging for young people, a number of issues and concerns were raised.

This included several respondents suggesting that the criteria should recognise that relevant and engaging STEM learning should be present across all parts of the curriculum, and not limited to STEM disciplines. This included reference to the importance of STEM experiences across both formal and informal education settings. Respondents also suggested that the criteria should make reference to children and young people recognising their experiences as STEM learning, and genuinely engaging with the opportunities provided. This included understanding how their STEM learning experience related to their wider learning and life experience.

Outcome 2 seeks to ensure that **all young people and their families, irrespective of background and circumstance, understand the importance and relevance of STEM to their future success in life and work**. Again comments indicate a common view that understanding the relevance of STEM should be a significant element of the strategy. However, some issues or concerns were raised – including the extent to which it will be possible to measure understanding across young people and their families (this is considered further later in this section under cross-cutting issues).

A small number of respondents suggested including reference to the importance of young people and their families having an understanding of the relevance of STEM at key stages where education and career decisions are made. In this context, a small number of other STEM education and professional/ representative bodies also suggested that the scope of the outcome should be expanded to include ensuring “carers and influencers” (including teachers) understand the relevance of STEM. A science engagement respondent also raised a broader point around ensuring understanding of the relevance of STEM enables young people and adults to make better decisions and choices to improve their lives. An other professional & representative body respondent questioned the extent to which this outcome is achievable, and suggested “increase in understanding” as a more realistic alternative.

Outcome 3 focused on achieving **improved gender balance across STEM qualifications and courses at school, college and university, and Modern Apprenticeships in the workplace**. A substantial number of respondents provided specific comment on this success criteria, with most of these suggesting areas where the criteria could be extended.

The most common point raised by respondents was that the criteria should be based on a broader understanding of diversity (beyond gender), including reference to the importance of responding to the intersectionality of disadvantage. This is consistent with views noted at Question 2 in relation to the Equity theme. These respondents made reference to a range of other disadvantaged groups and forms of inequality including socio-economic disadvantage, ethnicity, disability, care leavers, and geographical disadvantage.

A small number of respondents suggested that the criteria is extended to include explicit reference to raising the profile of STEM skills across all subjects, and in particular subjects that young women are likely to continue to want to study in substantial numbers. This appeared to be linked in part to concerns that previous initiatives have failed to deliver equity of STEM participation, and a view that a change of approach is required.

A small number of respondents wished to see improved gender balance (and better representation of other disadvantaged groups) in the workplace as part of the criteria. This included a suggestion that improved balance in the workplace should be expected as a result of improved equity in STEM education and training. Another professional/representative respondent also suggested that the strategy should recognise the impact of women's employment experience on their engagement with STEM.

A small number of respondents suggested more detailed changes to the terminology used in outcome 3. This included expanding the reference to Modern Apprenticeships to include all "work based learning routes" to better reflect the range of pathways available, and that "gender equality" would be a more appropriate term than "gender balance".

Outcome 4 is focused on ensuring **there are a wide range of STEM pathways through further and higher education and other training that young people and adults can follow, well-matched to labour market need and their needs and aspirations**. Relatively few respondents raised issues or concerns specific to this criteria. Points raised included a small number of college, STEM industry and STEM education bodies suggesting that the criteria includes emphasis on the connectedness of STEM pathways, and recognition that these pathways can extend from school, throughout the education and training experience. An other professional/representative body also suggested that the outcome should highlight the importance of raising young people's awareness of the range of STEM pathways. A third sector respondent referred to evidence that availability of a wider range of courses can have a negative impact on equality, and noted that this could imply that delivery of Outcome 4 could be in conflict with Outcome 3 (improving gender balance).

Outcome 5 is around **employers being confident about the STEM skills and capability of their current and future workforce**. Again, comments from respondents indicate support for the focus on STEM skills and capabilities meeting employers' needs, with several respondents suggesting areas where this focus could be strengthened. This included a small number of respondents suggesting

extension of the outcome to include reference to employers' confidence in and understanding of STEM educational programmes, and ensuring employers engagement in STEM education. A small number of respondents also highlighted the need for clarity on the specific STEM skills required, including that employers understand and can recognise the STEM skills and capabilities that will benefit their organisation. An education sector respondent also suggested that the criteria should include a specific measure of the level of STEM skills in entrants to the workforce.

Other success criteria suggested by respondents

In addition to the above points specific to the five success criteria, a substantial number of respondents raised broader issues or concerns for the set of criteria proposed by the draft strategy, and themes which they felt should be better represented. This included a small number of respondents who questioned use of terminology in the draft strategy, and in particular the interchangeable use of "outcomes" and "success criteria".

A key concern raised by a substantial number of respondents (by around a third of those making comment at Question 3) related to the extent to which the success criteria are "SMART", and how progress against the criteria will be measured. These concerns appeared to be a particularly significant factor for some of those who disagreed with the success criteria at Question 3. Respondents raised concerns around how measurable the criteria are likely to be across all five criteria, but included particular reference to difficulties measuring whether children and young peoples' experience of STEM learning is "relevant and engaging", measuring employers' confidence in STEM skills and capability, and assessing young people's understanding of the importance of STEM. Comments from these respondents included suggestions that it will be necessary to develop meaningful measures and KPIs, and associated baselines, which are sensitive to genuine change. A number of respondents made suggestions for specific measures of success, including reference to established performance frameworks and measures.

Also in relation to measuring progress, a small number of respondents suggested that the scale of the problem is currently not properly quantified, for example the proportion of teachers receiving career long professional learning on STEM. These respondents suggested that more detail is needed on the scale of the change required. A STEM industry respondent also suggested a need to specify timescales for progress towards the outcomes.

In terms of other cross-cutting issues raised, respondents also commented on the extent to which the outcomes focus on the experience and skills of "children and young people". A number of respondents, including a mix of respondent types, wished to see this extended, including reference to the importance of STEM engagement in the early years, and to the need to improve STEM skills and experience for adults and those returning to STEM learning and training.

Comments also included reference to specific themes or issues which respondents felt should be given a more prominent role across the success criteria.

Suggestions included:

- Several respondents suggested an additional outcome linked to an increase in numbers of people undertaking STEM – across education and training, but also an increase in people entering STEM positions in the workforce. This included suggestions for a measure of longer-term success, for example in terms of STEM skills being retained and/or individuals remaining in STEM fields. These measures were also referenced in comments from a science engagement respondent around the need for a measure focused on changing the perceptions and attitudes towards STEM across society as a whole.
- A range of respondents made reference to the importance of educators and others working with children and young people to develop STEM enthusiasm and skills. This included a wish to see the criteria make specific reference to the need to build educators' confidence, knowledge and skills in relation to STEM.
- A third sector respondent suggested more specific reference to improved attainment in STEM subjects, and that raising attainment should be a key outcome for any education strategy.
- A science engagement respondent suggested that sustainability is explicitly referenced as a success criteria.
- A university respondent wished to see a criteria that reflects the need for a holistic focus on STEM, across sectors and stakeholders.
- A small number of university and STEM industry respondents suggested an outcome around Scotland being recognized as a leader in its commitment to STEM and STEM education and training – including for example benchmarking against comparable education systems.

Scope of the strategy

The draft strategy relates to children and young people as they move from early learning through school and on into further and higher education, other training or employment. It also emphasises the importance of the current workforce and employers in ensuring development of the STEM knowledge and skills required for the current and future labour market. There is a particular emphasis on early years as being crucial for building enthusiasm and aspiration for STEM, and foundational STEM skills and knowledge. While children and young people are a vital aspect of the strategy, the draft makes clear that learning, work-based learning, training or re-training for adults – across a range of settings - and including specifically girls and women, is of equal importance.

Question 4 sought respondents views on the scope of the strategy as set out in the draft.

Q4. Do you think the scope of the Strategy is right? Tell us if you think it should exclude something or include anything else. For example, should it include training and development that employers provide for their workforce?

A total of 170 respondents provided further comment at Question 4, nearly 9 in 10 of all respondents. A substantial proportion of those making comment, more than 2 in 5, indicated broad support for the scope of the strategy as set out in the draft. This included particular reference to early years, and the importance of this stage in building enthusiasm for STEM. Respondents also highlighted the recognition throughout the strategy of the breadth of education and training experiences, and diversity of pathways to STEM education and employment. This included reference to the range of settings for education and training, and in particular reference to more informal education in settings such as science centres and museums.

However, most of those providing comment raised issues and/or suggested specific areas for adjustment to the scope of the strategy. This included several STEM industry, STEM professional/representative bodies, university and third sector respondents expressing concerns that the scope of the strategy may be too broad, and/or that prioritisation of key groups or sectors is required. A small number of respondents suggested that for example a narrower focus specifically on improving STEM engagement and skills for children and young people may be more effective, and were concerned that the broader scope may “dilute” the impact of the strategy.

A third sector respondent also suggested that a specific account of the scope of the strategy should be included earlier in the document, to ensure that the key target groups are clear from the outset.

A substantial number of respondents highlighted specific issues and themes which they felt should be better represented in the scope of the strategy. Key suggestions are summarised below:

- The most common was a suggestion that the role of employers could be stronger across the strategy. This was raised in relation to the importance of employers engaging with and helping to shape the approach to STEM education, and specifically as providers of training and professional development. Around a third of those providing comment at Question 4, including a range of respondent types, expressed support for the scope of the strategy being expanded to include training provided by employers. This included suggestions that CPD provided by employers is particularly important in ensuring STEM training is tailored to rapidly changing technologies and labour market needs. However, several respondents (including STEM industry, other STEM education/professional bodies, third sector, university and individual respondents) disagreed with expanding the scope to include training provided by employers. These respondents referred to potential for this to detract from the central

requirement for more young people engaging with STEM activities and developing more specialist STEM skills through higher and further education, and suggestions that workplace training is often specific to the employer such that it may not provide individuals with transferable skills.

- Respondents' comments on the role of employers also included specific reference to the value of employers' engaging across education sectors (including early years, primary and onwards) and with communities to support STEM engagement, and the extent to which employers have insight into likely future trends in the need for STEM skills across the labour market. Several respondents also specifically noted the potential contribution of employers to improving gender equity and inclusiveness. This includes through development of flexible and sustainable careers to tackle the high attrition rate for females in STEM industries, providing training which recognises the specific experiences and needs of female employees, supporting female adult returners, and the importance of a positive workplace experience for girls and women maintaining a role in STEM. Some respondents also referred to the importance of supporting employers, including small and medium enterprises, to ensure the quality of the training offer across STEM industries.
- Several respondents suggested a clearer reference to the importance of educators – particularly primary and secondary teachers - in achieving the improvement in education required by the strategy. This included reference to the need for suitable resourcing and STEM training for current teachers and as part of the training process for new teachers, and the benefits of teachers' engagement with STEM employers.
- A small number of education sector and individual respondents wished to see stronger emphasis on STEM literacy across the population more widely, including adult learners undertaking Continuing Professional Development.
- A number of respondents recommended stronger emphasis of the role of the “influencers” of children and young people including parents, carers, siblings. This included a small number of respondents referring specifically to the role of intergenerational and family learning.
- Several respondents suggested that the strategy could more explicitly refer to the importance of informal learning outside the classroom, including settings such as science centres and museums.
- A small number of respondents referred to the connections between STEM skills across other disciplines, and for example a suggestion that the strategy could encourage a “whole school” approach to improving STEM participation across non-STEM disciplines. This included specific reference to recognising mathematics within the scope of the study as a foundational skill for STEM engagement, as a key skill across non-STEM disciplines, and the significance of mathematical sciences for the Scottish economy.

- A substantial number of respondents suggested that later primary years and secondary school should be a particular focus for the strategy, in addition to the current emphasis of early years. This included a suggestion that disengagement and the “gender divide” in STEM participation occurs at secondary school, even where there is strong engagement during early years. Several respondents referred to the importance of ensuring that engaging and inspirational STEM experiences continue through primary and secondary school to maintain engagement.
- Reflecting points raised earlier at Questions 2 and 3, several respondents suggested that reference to gender balance in the strategy scope should be expanded to support inclusion of other protected characteristics and disadvantaged groups. A small number of third sector and college respondents also suggested that the strategy scope should include a clearer commitment to ensuring gender balance from the early years, through school and further/higher education, and into training and employment.
- A small number of respondents wished to see more specific reference to the role of STEM skills. This included the importance of core STEM skills in enabling individuals to make the transition through education and into training and employment. and suggestions that the strategy should provide a comprehensive discussion of skills shortages and clarity on the types of skills required.
- An academic/research institute respondent suggested that the strategy should take the opportunity to include support for retention of highly-skilled fixed-term researchers in Scotland’s STEM sector through opportunities to diversify their skills.

Current Activity

The strategy notes that the range of STEM education and training activity currently underway provides “much to build on”. The draft includes an annex setting out a detailed picture of current STEM activity across age groups and sectors including early years, schools, colleges and universities, in other settings such as via the Young Workforce Programme and apprenticeship opportunities, through science centres and museums, and through community learning and development.

The draft strategy included two consultation questions in relation to current activity, seeking views on the extent to which this current activity will contribute positively to the strategy, and about where respondents feel there needs to be a change.

Current activity and fit with the draft Strategy

Question 5 asked for views on the extent to which current STEM education and training activity is a good fit with the draft strategy, and the contribution that this activity will make to the strategy.

Q5. Give us your views on whether you think the actions already underway across the sectors on STEM fit well with the Strategy and will contribute positively to it.

A total of 158 respondents provided further comment at Question 5, 82% of all respondents. This included 104 group respondents, and 54 individuals.

A substantial proportion of respondents gave a broadly positive view on the contribution that current STEM activity will make to the draft strategy – a little more than a third of those providing comment felt that there is a good fit between current activity and the strategy. This included a broad cross-section of respondent types, although comments suggest that colleges and universities, academic/ research institutes, STEM industry, and STEM industry professional/ representative bodies were most likely to take a positive view here.

Relatively few respondents expressed strongly negative views about extent to which existing action supports the draft strategy. However, respondents did raise a range of concerns around specific aspects of current activity and the extent to which this is making a positive contribution – this included some of those who took a broadly positive view on the fit with the draft strategy. For some respondents, these concerns were linked to suggestions that the annex included with the draft strategy highlights the range and volume of activity underway, and questions around why more significant progress has not been made.

- A lack of **coherence and connectedness** across the range of STEM education and training activity was the issue most commonly raised by respondents – and the strategy was highlighted as a means of providing this. Around 1 in 5 of those providing comment made reference to a lack of coherence across activity, including a broad cross-section of respondent

types. Concerns here included reference to coordinating (and encouraging) cross-sector activity, in ensuring “fit” between education and training and employment sectors, and a need to maximise the impact of activity (and provide meaningful measures of that impact). This was highlighted by a number of respondents as particularly important in the context of the significant volume of STEM education activity currently underway, and concerns that current activity could be delivering greater benefits.

- The latter point was also linked to concerns that there is a **lack of measurable outcomes and evidence on the effectiveness** of initiatives and approaches, and a lack of awareness and sharing of good practice. This issue was specifically referenced by a number of respondents including education sector, STEM education and professional/representative bodies and third sector respondents.
- A lack of a strategic approach to improving **STEM qualifications, skills and confidence for teachers** was also raised as a concern by a number of respondents including science engagement, STEM industry and professional/representative bodies and third sector respondents. This included reference to a need for strong STEM skills across all stages, but particularly for early years and primary teachers given the strategy’s focus on these stages.
- Several respondents, across a range of respondent types, suggested that there is a lack of genuine **recognition of and commitment to gender equity**, with gender a fundamental element in the design of initiatives. This included reference to activity across education sectors (from early years upwards), in training delivered by STEM employers, and in STEM employees’ experiences more widely.
- **Funding and resourcing** constraints were highlighted by several respondents. This included specific reference to the need for additional resourcing to support work to improve gender and deprivation balance, improving STEM skills and confidence in teachers, and ensuring access to STEM specialist teachers across secondary schools.
- A small number of respondents suggested a lack of clarity on the specific **STEM skills required**, including for example a need for a stronger focus on mathematics.
- A university respondent felt that there is insufficient inter-disciplinary working to raise STEM awareness across the curriculum.
- A university respondent suggested that a broader range of opportunities are required for **experience of STEM and vocational pathways** such as internships or Modern Apprenticeships.
- A science engagement respondent suggested that there are geographic disparities in access to STEM education and training activities, including schemes such as the STEM Ambassador programme.

- A STEM industry professional & representative bodies felt that there is a need to ensure that engagement with employers is not limited to larger employers and colleges, and includes for example small and medium enterprises.

In addition to the above concerns regarding the range of current STEM activity, some respondents queried the presentation of current activity in the strategy. This included suggestions from a small number of STEM education and professional/representative bodies and science engagement respondents that the annex does not adequately represent the degree of variation in the activities listed, including for example highlighting where activity is part of a large programme of work, or a smaller project. Others felt that the strategy needs to capture on-going work more comprehensively, including reference to specific activities which respondents felt could be better highlighted by the strategy. An academic/research institute also suggested that it may be helpful to structure the Annex to link more clearly to the strategy aims and priority themes.

Respondents referred to a broad range of specific STEM education/training programmes and initiatives, including some providing significant detail on approaches taken and how these can contribute to the draft strategy. A number of common themes were evident across these examples, and we provide a brief summary of these below:

- The range of **collaborative approaches and partnerships** was the area most commonly referenced, primarily by colleges and universities and STEM industry respondents. Examples provided involved collaboration and support across disciplines and sectors, from the early years upwards, and with a particular focus on stronger employer engagement in STEM education and training. These respondents referred to a broad range of partnerships and initiatives including for example the STEM Ambassador programme, vocational pathways such as Modern Apprenticeships, and community learning and development partnerships.
- Several respondents, and particularly colleges and universities, highlighted current action around improving **gender and deprivation balance** as making a positive contribution to the strategy. This also reflected a clear view that the emphasis on equity is a positive aspect of the strategy. However, a college respondent expressed concerns that this activity is having a limited impact at present (this is considered further at Question 6).
- A small number of STEM industry professional/representative and other STEM education and professional/representative bodies referred to the contribution being made by ongoing work **delivering STEM professional development and support** to teachers and others involved in delivering STEM education and training.
- A small number of respondents highlighted work to **assess STEM skills requirements** at a local and regional level, and initiatives to improve digital skills. This included a suggestion from a college respondent that ongoing

review will be required to ensure a fit between education and training activity, and changing skills requirements.

- A small number of respondents made specific reference to the contribution being made by **innovation centres**.
- A university respondent referred to approaches specifically focused on adult learning, and supporting “returners” to re-engage with STEM.

Views on changes required to current activity

Question 6 asked for views on aspects of current activity where change is required – whether approaches that required modification, or activity that should be ceased.

Q6. Tell us about activity currently ongoing that you think could be adapted or stopped and why.

A total of 130 respondents provided further comment at Question 6, around two thirds of all respondents. This included 88 group respondents, and 42 individuals.

The majority of those commenting highlighted specific areas where they felt that current approaches could be adapted, but some made a range of broader points around the range of ongoing activity. For example, a number of respondents referred to the significant volume and diversity of STEM education and training activity, including suggestions that a considered approach is required to coordinate activity to minimise duplication. This also included reference to variation in the distribution of good practice, and suggestions that there are significant differences across local authority areas in good practice examples.

Respondents also referred to factors which had restricted the impact of initiatives. These included examples where the breadth of adoption had been too limited to deliver the desired outcomes, where funding constraints had limited take-up and/or impact, and where flexibility in funding is required to ensure activities can be delivered to maximise impact.

In terms of more specific points made by respondents in relation to where changes of approach are required, the main points were:

- Better coordination and connectivity is required to improve impact, ensure fit with skills requirements, and minimise duplication. This was highlighted by a substantial number of those making comment, included some suggesting there is a need to focus activity on a smaller range of better resourced initiatives.
- More and better collaboration across education sectors and with the STEM industry was also suggested by a substantial number of respondents. This included a particular focus on better engagement between education activity and STEM industry (including a need to better coordinate this engagement to

minimise duplication), supporting more “outreach” work across education sectors, and engagement between education sectors and third sector bodies.

- Respondents also felt that more work is required around recruitment, development and retention of teachers. This was highlighted in reference to all stages, but included particular concerns regarding STEM skills and confidence amongst primary teachers and provision of specialist teachers at secondary level. The specific challenge of attracting STEM graduates to education given the disparity in pay with the private sector was also mentioned.
- Several respondents suggested a need for more work to engage with the influencers of young people. This included suggestions that engagement with parents is a particular weakness, but wider engagement with other influencers and the community was also suggested. These respondents made specific reference to more work to enhance family understanding and appreciation of STEM, and initiatives to support STEM-focused community engagement.
- Improving information and advice to young people was highlighted by several respondents. This included a particular focus on providing the information and advice required to support decisions at key stages, for example in relation to subject choices and career pathways.
- A small number of respondents referred to the volume of initiatives and agencies working across STEM education and training, and suggested a need to streamline information for practitioners to assist them in navigating this complexity.
- Respondents referred to a range of specific bodies and programmes where they felt that expansion and additional funding or support could bring positive benefits, including improving access and addressing geographic variations in access. This included SSERC, STEM Ambassadors, Science Centres, Primary Engineer, Innovation Centres, Developing the Young Workforce, ScotCHEM, Developing the Young Workforce, and examples of whole-school and cluster approaches.
- Respondents also identified broader themes or initiatives where they felt that more funding is required. This included around addressing gender and other inequalities (such as recruitment of under-represented groups to Modern Apprenticeships, positive action programmes, improving geographic access across Scotland), addressing gaps in specialist teacher provision, expanding collaboration and “outreach” across education sectors, and support to small and medium enterprises to deliver STEM engagement and training.
- The need to develop a more in-depth and structured understanding of the effectiveness of current approaches was also highlighted, particularly to underpin resourcing decisions. This included reference to improving networks to identify and share good practice and learning.

- A small number of respondents wished to see more support for education and other experiences in different settings, including outdoor education.
- The development of mathematics and numeracy skills was also mentioned by a small number of respondents as a barrier to STEM engagement, and an area where additional work is required.

Implementation

The draft strategy proposed a number of principles and areas for implementation where new or scaled-up action can be taken. The strategy makes clear that the proposed approach to implementation seeks to build on existing local and regional approaches, learn from international best practice, and listen to views and suggestions provided through the consultation.

The draft strategy included two consultation questions in relation to implementation. These sought views on the principles for implementation set out in the draft strategy, and suggestions for other approaches that the Government could take to ensure a more coherent approach, and to maximise impact.

Principles for implementation

The draft strategy set out three principles that will shape the approach to implementation focused around improving understanding of the fit between STEM skills requirements and education/training activity, simplifying and streamlining activity, and developing meaningful performance measures. The principles as set out in the draft are:

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

Questions 7 sought views on these principles.

Q7. Do you agree with the principles set out for implementation?

A total of 149 (of 192) respondents answered Question 7. A large majority, 81% of those answering the question, agreed with the principles set out in the draft strategy. The majority of respondents across all respondent types agreed with the principles, although there was some variation evident - support was most widespread amongst academic/research institutes, STEM industry and STEM industry professional/representative bodies, and local authority/public body respondents.

A total of 28 respondents, 19% of those answering, disagreed with the principles for implementation. This included 14 group respondents across a range of respondent types, and 14 individuals.

Question 7: Response by Respondent Type

Do you agree with the principles set out for implementation?	Yes	No	No answer	Total
Education sector - Colleges	8	2		10
Education sector - Universities	5	1	5	11
Education sector - Schools/Other	5	1		6
Academic/Research Institute	4		1	5
Science engagement	9	2	1	12
STEM industry	12	1	1	14
STEM industry professional & representative bodies	13	2	2	17
Other STEM education, professional & representative bodies	5	2	3	10
Other professional & representative bodies	2	1	9	12
Local authorities and other public bodies	8		1	9
Third sector/Non-profit organisations	8	2	5	15
<i>Groups (Total)</i>	<i>79</i>	<i>14</i>	<i>28</i>	<i>121</i>
Individuals	42	14	15	71
TOTAL	121	28	43	192
Percentage of those answering	81%	19%	-	100%
Percentage of all respondents	63%	15%	22%	100%

A total of 98 respondents provided further comment at Question 7, 51% of all respondents. Most of those providing written comment agreed with the implementation principles (61 of 98 providing comment), although a large proportion of those answering 'no' at Question 7 provided further comment, as did a number who had not answered the yes/no question.

A substantial number of respondents used written comments to emphasise their support for the implementation principles, including specific aspects of the principles which were seen as particularly important. This included reference to the importance of reviewing skills requirements to ensure fit with education and training, the need for intelligence-driven implementation based on clear performance measures, the reference to streamlining activity and the need for greater clarity and better use of resources, and a better understanding of the barriers to engagement and experience of particular groups.

Most of those providing written comment at Question 7 raised issues, points for clarification, or suggestions for amendment. This included comments on specific aspects of the three implementation principles, and other issues and suggestions for additional principles. These are summarised over the following pages.

In relation to **principle 1, understanding the fit between STEM skills requirements and education/training activity**, respondents made the following points:

- The need for intelligent use of data and more qualitative information on skills requirements to provide a rounded picture of the range of current and likely future requirements.
- The importance of engagement with the STEM industry to inform understanding of STEM skills requirements, including ongoing engagement to ensure we are sensitive to changes in requirements over time.
- Reference to ongoing work to assess labour market needs as a potential resource for this principle.
- Suggestions that the principle could be stronger by emphasising the identification of current and future skills needs, and adapting the education and training system to meet these needs.
- In relation to barriers for particular groups, suggestions that the principle must recognise the potential complexity of barriers (including development of multiple measures to reflect this), but must also seek to identify approaches to overcome identified barriers.

In relation to **principle 2, around simplifying and streamlining activity** to realise efficiencies and value for money, respondents made the following points:

- Requests for further detail on the approach to this principle, including some expressing specific concern that this principle could imply a reduction in current provision and funding. These respondents suggested that this would undermine delivery of strategic aims and priorities, with several explicitly referring to a need for increased funding.
- Suggestions that streamlining is undertaken intelligently, including with reference to use of performance information to assess impact, and likely efficiency savings. Respondents also highlighted the importance of a coherent and coordinated approach to streamlining activity, led by national policies. This included reference to other initiatives and policies where alignment would be beneficial such as the Enterprise and Skills Review and Commission on Widening Access. A university respondent also cautioned that streamlining should not mean focusing activity on “traditional” STEM subjects at the expense of developing STEM skills across other disciplines.
- Recognising different challenges across Scotland, particularly in terms of geography, and the resources required to overcome these.

- A suggestion that funding approaches could play a role in supporting efficiencies, for example longer-term funding to enable development and planning.

In relation to **principle 3 on developing meaningful performance measures**, respondents made the following points:

- The importance that KPIs (and collection methods) are well designed through a coordinated approach which ensures a coherent set of measures. This included specific reference to the potential role of engagement with the STEM industry, to provide information but also to help ensure the correct measures and questions are set.
- Concerns that development of discrete KPIs should be part of developing a broader understanding of the benefits delivered by STEM activity, and does not become a “box ticking exercise”. This included the importance of sharing evidence on performance and impact to enable this to shape ongoing design of STEM programmes and activity.
- Suggestions that performance measures should not be limited to “Scottish Government and our agencies” as implied in the draft, but also include reference to other partners.
- A college respondent suggested that detail is required on who will be leading and coordinating the collation and reporting of performance measures. A specific suggestion that governance mechanisms and assessment of performance has access to specialist gender expertise.
- Reference to the importance of sustainability as a key principle for performance measures.
- Reference to specific evidence sources and ongoing work that can inform assessment of performance.

Respondents also raised a number of **other issues** which applied across multiple implementation principles, or reflected broader views on the approach to implementation. The key points here are summarised below:

- A number of respondents were concerned that the principles are too ambiguous (including for example what would constitute “meaningful” measures). This included suggestions that a clearer and more ambitious statement of approach is required, and that this is linked more explicitly to the strategy’s priority themes. This point was raised by a broad range of respondents, but appeared to be a particular concern for some of those who answered “no” at question 7.
- Respondents also suggested that connectedness and coherence are key themes for all three implementation principles. Some suggested a need for greater coordination of approach including reference to national policies, the

potential role of a single agency to support and coordinate implementation, and establishing regional hubs.

- Several respondents suggested an additional principle focused more specifically on improving standards of STEM education and training including support to providers, and training/experience for educators. This included reference to developing STEM knowledge and skills, but also pedagogical approaches to support STEM education and training. A college respondent suggested a need for a wider understanding of STEM principles, capabilities and careers across teachers and other education professionals.
- A small number of respondents referred to the importance of improving public understanding and appreciation of STEM, including suggestions that this could form an additional principle.
- A STEM industry respondent suggested an additional principle recognising the importance that STEM activity understands and responds to the needs of children and young people – and the extent to which this varies across genders and other groups.
- A small number of respondents specifically noted the importance of dialogue and collaboration between all education sectors and employers for all three principles. It was also suggested that ongoing dialogue across sectors and with employers will be required to continue to shape implementation of the strategy.
- A number of respondents raised concerns that the role of Chief Scientific Adviser may not have the capacity to act as conduit between Government and STEM employers. This included reference to other elements of the Adviser’s brief, and that this is a part-time role. Several respondents suggested the potential for other partners to support the Chief Scientific Adviser in this role, including reference to Learned Societies and the Scottish Science Advisory Council.
- A small number of respondents were concerned that phrasing of the three principles implies that the value of STEM education and engagement is purely functional, rather than being of intrinsic value.

Implementation approach

Question 8 sought views on what else the Government should do – in addition to the principles for implementation discussed at Question 7 – to ensure a more coherent approach to STEM education and training that maximises impact.

Q8. What else should Government do to ensure a more coherent approach and maximise impact?

A total of 157 respondents provided further comment at Question 8, around 4 in 5 of all respondents. This included 104 group respondents and 53 individuals.

Several of those making comment referred to key aspects of the three principles discussed at Question 7. This included for example ensuring implementation is based on an accurate understanding of skills gaps and barriers to engagement, and the need to simplify the range of activities currently underway. However, most of those providing comment suggested additional principles or approaches to implementation of the strategy. Respondents raised a number of issues, including reference to a significant range of specific initiatives and programmes. A number of **common themes** emerge in relation to respondents' views on the implementation approach:

- The importance of ensuring a coordinated approach to maximise impact and minimise duplication, including reference to the potential value of a centralised hub to collate activities. Linked to this point, several respondents suggested the need for effective communication and promotion of a coherent message around STEM engagement and skills development.
- The need to support collaboration across all partners including education sectors, science centres, qualifications bodies, funding bodies, and STEM industries. This was in relation to ensuring design of education and training is fit for purpose, to support delivery, and enable sharing of good practice. This included a suggestion that there is a need to address current barriers to engagement between employers and education partners. Comments here included specific emphasis of the contribution that the STEM industry can make – to improving engagement and understanding of STEM, and specifically to the development of education and training programmes. These respondents suggested a need to increase engagement, while ensuring this remains sustainable. This included reference to a potential need for support or incentives for employers.
- A need for a collaborative approach to implementing the strategy, which is transparent on the outcomes of the consultation, and involves key stakeholders in development of specific elements of the implementation process.
- The importance of a flexible approach to implementation, that is able to respond to changes over time. This included reference to the need for regular review of skills requirements (potentially led by the Chief Scientific Adviser), and approaches that are able to respond to changing skills requirements more quickly than “traditional” education programmes.
- Several respondents recommended a stronger focus on equity across approaches – for gender and also for other disadvantaged groups including disability, care experience, and rurality.
- A university respondents suggested a stronger focus on recruitment and retention of good teachers, recognising their critical role in delivering improvement in STEM standards and engagement.

- A university respondent suggested a need to ensure sustainability of implementation, and provision of the funding streams required to deliver strategic aims and priorities. This included reference to specific initiatives that have ended as a result of funding being terminated.
- A university respondent suggested greater emphasis on the role of creative and critical thinking to drive STEM innovation, alongside development of more vocational STEM skills.

In addition to the above points, respondents suggested a range of **specific initiatives and approaches**. This included:

- Approaches that promote and support multi-agency collaborative working were recommended by a substantial number of respondents, including reference to existing examples such as the Scottish STEM Partnership. Specific suggestions included development of a central hub or resource to support collaborative work and share good practice; establishing a central independent group able to provide advice on STEM initiatives and approaches; development of regional hubs or working groups bringing together education, employers, third sector, and Government; using funding processes to encourage greater collaboration (rather than competition) between STEM providers; and using the role of the Chief Scientific Advisor to promote dialogue across partners on how to work together in promoting STEM.
- Equity related initiatives, embedding unconscious bias training throughout STEM education, training and professional development. Reference was made to ensuring a role for EQUATE Scotland initiatives to provide diverse role models, for example via the STEM Ambassadors programme and that equity indicators are built into the monitoring of progress.
- Promoting initiatives that involve engagement with the STEM industry, in developing STEM engagement, and identifying skills requirements. It was suggested that Innovation Centres could have a role in collating this work given their existing links with STEM industry and other partners, and that a national STEM employer group could be established to provide leadership. It was also suggested that engagement with STEM employers – and particularly SMEs - is required to assess support required to maintain and develop STEM education and engagement.
- Suggestions for development of a “Task Force” or “Champion” to drive implementation of the strategy. A STEM industry respondent also suggested that the role of the Chief Science Advisor is expanded to the Chief STEM Adviser.
- A more comprehensive understanding of STEM engagement and activity, including sharing of good practice and mapping of STEM activities to ensure all partners are able to participate. A particular focus on improving understanding of equality-related initiatives was also suggested. One

respondent also suggested that implementation should draw on activities elsewhere in the UK, including the Wakeham review of STEM degree provision and graduate employability.

- Development of a monitoring and evaluation framework, incorporating appropriate quantitative and more qualitative measures to provide a genuine account of the impact of STEM engagement activity. This included reference to the importance of engagement with partners to inform design and implementation of the framework.
- Research to develop a better understanding of learners' interest in and attitudes towards STEM, and using this to shape the approach to STEM. This included particular reference to the P7/S1 transition, in the context of PISA findings which indicate a decline in interest and positive attitudes towards science from adolescence. A small number of respondents also emphasised the importance of parents and families in supporting learning, and that their perspective is included.
- Programmes to ensure educators across all sectors are equipped to deliver an inspiring and "more futuristic" curriculum. This included reference to improving STEM skills amongst future educators (for example STEM qualification as an entry requirement for primary teachers), increasing the focus on STEM within training for current teachers (for example enabling teachers to undertake CPD with STEM employers), and ensuring all schools have a clear STEM focus.
- Recognising the need to tailor approaches to fit the differing needs of different parts of the country - including for example larger urban areas and more rural and dispersed populations with lower school and STEM Ambassador populations. This included a specific suggestion for more targeted funding to enable further education and higher education institutions in high demand areas to make more offers to qualified applicants.
- Increased investment in enabling the current STEM workforce to update and develop skills, including a suggestion from a STEM industry respondent that given the scale of the workforce and the need for rapid improvement, this may be more important than apprenticeships and other vocational routes for new talent.
- Ensuring a good understanding across education sectors of the role of science centres, and the education programmes available to support STEM engagement.
- Consider development of minimum standards and sharing of good practice in delivery of informal science engagement.
- Ensuring parity of esteem for academic and vocational pathways, included a suggestion that greater and earlier access to vocational qualifications is required.

- Initiatives with a specific focus on developing digital skills, including Computer Science as a distinct discipline.
- A review of careers advice and skills development for children and young people to ensure this is fit for purpose, and that it inspires young people – and in particular that it presents the full range of available pathways.
- Funding to further expand the STEM Ambassador role, including for example funding a 6 month supplement to PhD studentships to act as Ambassadors.
- Enhancement and integration of school and further education qualification systems to ensure they fit with varying end points.
- Development and funding of “STEM clubs” to facilitate extra-curricular activities for those engaged in STEM.
- Initiatives to encourage the role of outdoor learning and nature in STEM engagement, including for example through training for educators.
- Requiring STEM education or vocational experience as a contractual condition for Government projects.
- Reference to specific bodies or partnerships such as SSERC and Developing Young Workforce teams, and suggestions that there is scope to raise awareness and use of these.

Proposed actions

The draft strategy includes a range of actions in relation to each of the four priority themes, including reference to key agencies leading on delivery. This section considers respondents views on the extent to which the strategy is clear and action focused, whether the proposed actions will deliver the required outcomes, and on the contribution that specific sectors can make to the areas for action.

A clear and action focused strategy

Questions 9 sought views on the extent to which the draft Strategy is clear and action focused – and the extent to which proposed actions will achieve the aims and intended outcomes.

Q9. Overall, do you think this Strategy is clear and action focused? Do you think that the actions that we propose to take nationally will achieve the aims and intended outcomes?

A total of 161 respondents provided further comment at Question 9, around 4 in 5 of all respondents. This included 108 group respondents and 53 individuals.

A substantial number of respondents indicated broad agreement that the strategy is clear and action focused, and/or that the actions will deliver the intended outcomes. Around 3 in 5 of those providing comment specifically indicated that they felt that the strategy is action focused and should deliver outcomes, while a number of other respondents suggested relatively minor amendments or additions which may imply broad agreement.

However, the majority of those providing comment raised concerns or suggested additional actions – this included most of those who gave a broadly positive view on the strategy. Most of those providing comment raised issues around the strategy as a whole, or that did not relate to specific priority themes. We summarise these below:

- A substantial number of respondents had concerns that the strategy and its actions are not clear. Some suggested that the proposed actions are ambitious and could deliver positive outcomes, but felt that the strategy lacked detail on how they will be achieved such that it was difficult to make a judgement on its likely success – and some were concerned about what was seen as subjective or “vague” descriptions of actions. A number of these respondents were also concerned that insufficient detail was provided on how the strategy will be resourced.
- A small number of respondents specifically referenced what they saw as the strategy’s reliance on enhancement of existing actions, and suggested that this will not be sufficient to achieve the degree of change required.

- Several respondents noted that better co-ordination of actions is required to support STEM across the UK, and concerns that the set of actions remains too complex and lacking coherence. Some felt that the actions need to be consolidated and rationalised.
- A substantial number of respondents noted that effective measurement of impact and progress will be vital, including suggestions that the Strategy needs to be data driven with better forecasting. The role of local authorities in governance and measuring progress was referenced here, as was benchmarking with leading nations. Some respondents also suggested that the actions could do more to draw on existing good practice.
- A small number of respondents referred to a need for better data on skills gaps and shortages, including more detail on specific skills. It was suggested that we need to be able to give young people guidance on future careers, including reference to the role of industry in providing guidance on future developments in their sectors.
- A small number of respondents referred to the importance of action being integrated across all ages and levels, ensuring continuity throughout the “pipeline”. This included a suggested need for a stronger focus on early years.
- A college respondent suggested that a change in perceptions and understanding of STEM and gender inequality is required before the proposed actions can have an impact.
- A university respondent felt that actions should better reflect the need to communicate the excitement and creativity involved in STEM.
- A small number of respondents suggested that actions must recognise the need for tailoring of approaches at a local and regional level.
- Several respondents suggested that the strategy should highlight the need for agencies leading delivery of the strategy to engage with other partners to shape the approach.
- A STEM education and professional/representative body made specific reference to the important role of Education Scotland in delivering actions, including ensuring that the organisation has sufficient capacity and resources to maintain this, and the potential requirement to review this role following the School Governance Review.
- A small number of respondents also highlighted specific issues which they felt were inadequately dealt with by the strategy. This included the role of (and ensuring sufficient access to) technicians in schools, colleges and universities; the value of inter-disciplinary learning; potential for professional learning communities, and the importance of creativity and the arts for STEM.

A number of respondents also made specific reference to the significant of **resourcing**, and the extent to which this may be a constraint on delivering outcomes – this was also reflected in comments noted earlier in relation to greater clarity on how the actions will be delivered. This included suggestions that, while the proposed actions are positive, it is the extent of financial support that will determine whether the strategic aims and outcomes are achieved – one respondent noted the importance of resourcing in relation to improving equity of access. Some were concerned that the draft strategy does not include the required detail to demonstrate how it will be successfully delivered.

Several respondents suggested that prioritisation of actions may be required, particularly if resourcing cannot support a broader set of actions. Assessment of impact of actions was highlighted in relation to prioritising actions. Potential “core” areas mentioned by respondents included improving understanding of the importance of STEM; mathematics, computing and science knowledge and skills as foundational for STEM; and improving STEM knowledge and skills for educators.

Whether proposed actions will achieve aims and outcomes

In addition to the broader points discussed over the previous pages, respondents commented on specific aspects of the areas for action identified under each of the four priority themes. This included a small number of respondents recommending that the presentation of areas for action is structured around education sectors to provide a more coherent picture for each sector, or that clearer linkages are made between proposed actions and the strategy’s principles, outcomes and priorities.

In relation to the theme of **Excellence**, the key points raised by respondents were:

- Suggestions that developing STEM skills and knowledge for educators will be absolutely essential to delivering the quality of STEM experience required throughout the education system, including further and higher education educators. Some felt that the strategy provided insufficient clarity on how this will be achieved, including specific concerns regarding the time and resourcing required. This included references to a need for STEM skills to be developed for teachers across the curriculum, beyond core STEM disciplines. Resourcing to enable educators to participate in STEM industry placements was also highlighted, and the importance of stability of employment for the benefits of this professional learning to be maximised.
- In relation to improving the pipeline of STEM teachers, several respondents suggested that development of new routes into teaching could include for example opportunities for international graduates to gain a Master’s degree while teaching in schools. One professional/representative body emphasised the need to ensure that expanding the range of pathways into teaching does not compromise standards. A third sector respondent also suggested a need to raise the attractiveness of the teaching profession. Some concerns were also raised in relation to increasing entry requirements for teachers, and the extent to which this could limit the pool of candidates to a level below that required.

- A college respondent recommended inclusion of further education, higher education and community education in the Digital Schools Programme and Making Maths Count.
- A number of respondents highlighted the importance of practical experience and work-based pathways in improving STEM skills, and suggested that these could be further emphasised. This included recommendations for further consideration to the resourcing of this experience and pathways, recognising the input of schools, colleges and employers. One professional/representative body also highlighted the parity of esteem across academic and vocational pathways as a continuing issue. A third sector respondent also highlighted a need to raise awareness of Modern Apprenticeships, and the range of pathways available. The extent to which access to these pathways varies across the country, and that rurality is a barrier for many, was also referenced. In terms of specific actions, respondents made reference to including colleges as key partners in the foundation apprenticeship programme, SCQF accreditation for foundation apprenticeships such that they are accepted by all Scottish universities, and growth in Graduate Level Apprenticeships supported by increasing the proportion of funding from the Apprenticeship Levy.
- A university respondent referred to the potential need to encourage high level STEM graduates to enter education, including the extent to which remuneration will need to be increased to attract this talent to the sector.
- A university respondent suggested a role for specialist STEM teachers in primary schools to drive the STEM agenda.
- A small number of respondents recommended that, alongside increasing uptake of “Masters” level learning, consideration is given to funding for “conversion Masters” to enable moves into STEM. The importance of adequate funding in this area was also highlighted, ensuring equal access across the profession. Although one professional/representative body respondent highlighted the potential impact on payroll, and ensuring this does not negatively impact on non-STEM teachers.
- A third sector respondent suggested that actions appear to be focused primarily on STEM at secondary level, and noted that a lack of STEM knowledge and confidence amongst primary teachers can become an early barrier.
- A science engagement respondent felt that the areas for action should better reflect the importance of the transition from primary to secondary for perceptions of STEM and subject selection.
- A small number of respondents suggested a need for significant improvement in careers advice – this included particular reference to secondary stage, but was seen as important across all stages.

- A science engagement respondent felt that actions should ensure that teacher recruitment and training provides the skills and confidence to deliver STEM through outdoor learning.
- In relation to benchmarks for STEM subjects, another STEM education and professional/representative body noted the delay to this as providing an opportunity to consider the role of STEM within these Benchmarks. However, another professional/ representative body respondent raised concerns regarding the bureaucratic burden of the benchmarks, particularly for primary teachers working across subjects.
- In relation to the Digital Schools Programme, some sought a clearer definition of what “digital” means for the programme, and how the programme will be sustainably resourced in terms of workload for teachers and ICT resources within schools.
- A third sector respondent referred to the importance of recognising equality and diversity across disciplines to provide students with a curriculum that is relevant to them – including reference to the work of the Higher Education Academy as a resource.

In relation to the theme of **Equity**, the key points raised by respondents were:

- Several respondents expressed a view that activity to date to improve gender equality has had limited impact, and a change of approach is required. This included suggestions for a greater focus on promoting STEM skills across a wider set of disciplines, and particularly those that continue to attract a significant number of female participants.
- A third sector respondent suggested that, while the strategy acknowledges the problem of gender stereotyping, it does not go far enough in tackling the contributing factors to stereotyping, nor how such stereotypes are propagated.
- Embedding gender equity in initial teacher training was highlighted as a potentially effective approach. This included addressing the gender imbalance of entrants to teacher training programmes, particularly for STEM subjects, to provide role models and more positive experiences for girls and women engaging with STEM. Including equality and diversity within initial teacher training was also recommended.
- A professional/representative body referred to connections between proposed actions and the Be What You Want project delivered by Close the Gap.
- A science engagement respondent suggested there is scope to leverage private sector activities to improve equity.

In relation to the theme of **Inspiration**, the key points raised by respondents were:

- A small number of respondents suggested that it is important that activity to inspire children and young people to engage in STEM, sets this in the context of the wider curriculum. This included emphasis on the need to equip young people and adults with STEM knowledge and skills that can apply across a range of career pathways.
- A third sector respondent suggested that inspiring participation in STEM should not rely solely on the education sector, and that greater emphasis on the contribution of Government and the STEM industry should be included. A university respondent also felt that more strategic use could be made of the Chief Scientific Adviser's role, to maximise the impact of her time.
- A university respondent expressed concern that a focus on this theme over a number of decades may have now met "saturation", such that significant further advances are not realistic.

Relatively few respondents specifically addressed the theme of **Connection**. The key point raised was around the value of information on the current labour market, and likely future skills requirements. A small number of respondents noted that it will be important that this insight is accessible to all stakeholders (including students, parents, teachers) at key stages to inform choices and aspirations.

Achieving equity of outcomes

Question 10 sought views on whether the Strategy will improve equity of outcomes, and invited respondents to suggest additional elements to improve this aspect of the strategy.

Q10. Will this Strategy improve equity of outcomes? If not, tell us what else it should include, in particular for women and girls and other groups of people – disabled people, care leavers and minority ethnic communities.

A total of 134 (of 192) respondents answered Question 10. Most of those answering (65%) felt that the strategy will improve equity of outcomes. However, there was some variation in views across respondent types, with support most widespread amongst the education sector, academic/research institutes, STEM industry and third sector respondents.

A total of 47 respondents, 35% of those answering, felt that the strategy will not improve equity of outcomes. This included 20 group respondents, with around half of these being science engagement and STEM industry professional and representative respondents.

Question 10: Response by Respondent Type

Will this Strategy improve equity of outcomes?	Yes	No	No answer	Total
Education sector - Colleges	6	2	2	10
Education sector - Universities	5	1	5	11
Education sector - Schools/Other	4	1	1	6
Academic/Research Institute	3		2	5
Science engagement	3	6	3	12
STEM industry	10	1	3	14
STEM industry professional & representative bodies	9	5	3	17
Other STEM education, professional & representative bodies	3	1	6	10
Other professional & representative bodies		1	11	12
Local authorities and other public bodies	5	2	2	9
Third sector/Non-profit organisations	8		7	15
<i>Groups (Total)</i>	<i>56</i>	<i>20</i>	<i>45</i>	<i>121</i>
Individuals	31	27	13	71
TOTAL	87	47	58	192
Percentage of those answering	65%	35%	-	100%
Percentage of all respondents	45%	24%	30%	100%

A total of 144 respondents provided further comment at Question 10, 75% of all respondents. These were split between those who felt that the strategy would improve equity of outcomes (65 providing comment) and those who disagreed (43 providing comment, nearly all of those who disagreed at Question 10). A number of those who had not answered the yes/no question also provided comment.

A substantial number of these respondents re-stated their broad support for the strategy's contribution to equity in relation to STEM – around a quarter of those providing comment made reference to positive aspects of the strategy in relation to equity. This included comments highlighting the central importance of achieving equity as part of the overall approach to STEM education and training. However, most of those providing written comment raised concerns or suggested amendments to the approach set out in the draft strategy. This included suggested changes from those who agreed with the overall approach to achieving equity, and those who had more significant concerns. The range of issues raised by these respondents were broadly similar, and we summarise the key themes over the following pages.

Respondents made reference to a number broader themes and issues that cut across the specific aspects of the draft strategy's approach to equity. This included a number of respondents across respondent types suggesting the strategy takes greater account of the need to tackle **underlying gender inequality and stereotypes** to enable the proposed actions to have the impact required.

Respondents noted specific issues such as the gendered nature of the home environment, tackling unconscious bias in the teaching workforce, and changing expectations and understanding about whether STEM is "for people like me". This included several respondents who saw a need for a strategic approach to public communication and engagement around STEM and equity of outcomes. It was suggested that this more fundamental shift in attitudes is crucial if significant progress is to be made in equity in relation to STEM education and training.

This also related to a view expressed by a science engagement respondent that achieving better gender and deprivation equity should be part of a fully inclusive approach that achieves equity across all disadvantaged groups. This included a perceived need for a strategic approach to public outreach in relation to STEM and equity (and gender equity in particular).

A number of respondents also saw a need to recognise the **scale of challenge** in achieving equity of outcomes, and acknowledging that long-term commitment will be required to achieve equity. This point was raised by a range of respondents including STEM industry, education sector and local authority respondents. This included some who felt that the draft strategy did not proposed sufficient new activity but rather appeared to focus on ongoing work, and a suggestion that more significant structural change is required to effect real change. Related to comments around the scale of the challenge in achieving equity, a number of respondents saw **resourcing** as a critical issue for the success of the strategy. These respondents expressed concerns regarding whether funding will be available to fully implement the strategy, particularly in the context of the draft making reference to achieving efficiencies.

A need for **coordination and coherence** of actions was also referenced by several respondents. This was seen as particularly important in the context of the breadth of activity underway, with respondents referring to a significant range of specific initiatives. References to coordination included suggestions that the approach to address inequality in STEM is aligned with other programmes. Respondents made reference to specific initiatives such as the National Improvement Framework, Close the Gap, Developing the Young Workforce, the Commission on Widening Access, and broader equalities-related policy. Some also linked the need for coordination to the sustainability of initiatives, and the extent to which it may be more effective to focus on supporting and ensuring the quality of a smaller number of good practice initiatives.

In terms of approaches to tackle inequality, respondents referred to the importance of **understanding people's experience of inequality and disadvantage**, and motivations for choosing subject areas and pathways. Some felt that the strategy has a strong focus on gender, but does not go far enough in addressing other forms of inequality – including deprivation, disability, ethnicity, rurality and

geography, and looked after children or care leavers. This included particular reference to the extent to which these forms of disadvantage intersect with gender.

A range of respondents highlighted the need for a **better understanding of the impact of equity-related actions**, and identifying the approaches that work. This related to concerns noted above regarding what was described as a “multiplicity of initiatives”, and a need for a structured assessment of their value and impact. Respondents noted that this assessment required baseline measures and ongoing evaluation of impact, and also identifying and sharing of good practice to inform ongoing activity. Some felt that the strategy should include a more specific set of actions focused on “women in STEM” with associated measures. Respondents also mentioned a range of specific approaches in relation to measuring impact including reference to Gender Action Plans as a basis for measuring progress, incorporating indicators of gender equality within HMI Inspectors reporting, encouraging stakeholders (and particularly employers) to publish information on equity performance, and linking funding to assessment of performance.

Respondents also raised a broad range of more detailed points around specific aspects of the approach to achieving equity of outcomes. This included reference to specific sectors and/or target groups for action. We summarise respondents’ views over the following pages.

The **recruitment and development of teaching staff** was highlighted as a vital element of the strategy. Specific points raised included:

- The importance of ensuring recruitment is effective in attracting more female teachers in STEM disciplines – to increase the range of role models and provide more positive experiences for girls engaging with STEM.
- Initial Teacher Education was seen as an opportunity to improve STEM skills and confidence amongst teachers. Several respondents referred to the importance that teachers are proficient in STEM, and a small number specifically suggested minimum STEM proficiency is a requirement for Initial Teacher Education. Respondents also highlighted the need to embed gender and equality training as a core element of teacher training.
- Respondents also noted that the confidence and skills of existing teacher workforce is crucial, particularly in terms of effecting more rapid change. Respondents emphasised the need to improve teacher confidence in STEM and gender, and suggested that improving confidence in early years practitioners should be a particular focus. This included examples of regular annual training for staff on gender awareness.

Respondents also raised a range of points in relation to **education sectors more widely** (i.e. in addition to the focus on teacher skills and confidence).

- Respondents saw a need to embed STEM and STEM equality across school activity. This included reference to the importance of gender equality being within the remit of those in leadership roles within schools, and highlighting the need for more activity to be embedded in classroom learning rather than

limited to lunchtime and after-school activity that is likely to attract students already engaged in STEM.

- A small number of respondents suggested a need for more activity to enable schools to engage with STEM industry and other partners, including coordination to ensure consistency of approach. This included a suggestion for additional funding to support more engagement for schools in economically deprived areas.
- Cluster working was identified as a model that has shown potential, with a lead role working across a number of schools to promote and support STEM confidence and skills. However, there was some concern that high school teachers going into primaries is not sustainable in the longer term.
- Another professional/ representative body raised concerns that the strategy does not include reference to Additional Support for Learning, noting a correlation between deprivation and additional support needs.
- Several respondents saw a need for greater emphasis on increasing opportunities for under-represented groups across further and higher education sectors. This included suggestions that institution-wide approaches are needed for further and higher education sectors, shaping how institutions engage with employers and identifying mentoring opportunities. Reference was also made to potential for a stronger role for further and higher education sectors in identifying and sharing good practice across sectors in relation to equity in STEM.

Engagement with children and young people was also a significant theme for respondents. Several referred to a need for a significant change in attitudes and understanding towards STEM, and that engagement with children and young people should be central to that. In terms of specific approaches, respondents made the following points:

- Role models and mentors, and particularly those with experience in STEM industries, were referenced as particularly important. These respondents highlighted the importance of role models being relevant and persuasive – in terms of achievements that are seen as attainable (and graded based on audience) and in representing a diversity of opportunity. The STEM Ambassadors programme was noted as a significant opportunity in this context – including suggestions that female STEM Ambassadors are funded and matched to schools and communities.
- A need to provide children and young people with a better understanding of STEM skills was noted, including as a means of ensuring children and young people are able to recognise their own skills and potential. Mathematical skills were identified as a particular barrier to STEM engagement, and respondents suggested that improving skills can make a significant contribution to improving gender outcomes. Respondents also saw a need for better information on pathways and careers options in relation to gender,

available at key points around subject choices. This included suggestions that greater flexibility is required across pathways – enabling lateral movement between subjects, and alternative articulation routes (including distance learning) being required to include gender and disadvantage as part of plans for widening access.

- Several respondents felt that the strategy lacked specific actions for the early years stage, and suggested that this is a key age group to address stereotypes and gender segregation. This included reference to the large proportion of female early years practitioners as an opportunity to develop more female role models in STEM engagement. Respondents referred to a range of examples including the Equality Challenge Unit 's early years good practice, Zero Tolerance guide “Just Like a Child”, Close the Gap produced the ‘Be What You Want’ resource for teachers and careers advisers, and work by Science Centres. However, one respondent suggested that teachers are no longer based in many nurseries and noted that this could be a barrier to addressing STEM and gender.
- The Gender Action Plan was referenced by a college respondent who saw value in extending gender action planning to early years, and to include other disadvantaged groups such as disability and ethnicity.

A number of respondents suggested that the strategy should include more emphasis on **industry engagement in education** as a key element of the approach to changing perceptions of STEM amongst children and young people, and as part of teacher training. These respondents noted that many teachers lack STEM industry knowledge, and some positive experiences were reported around employers’ willingness to make connections with schools and other education institutions. However, it was suggested that a framework is required to better enable this kind of engagement. In relation to specific elements of the engagement with STEM industry, respondents made the following points:

- Several respondents suggested that more emphasis is needed on the role of STEM industries and employers in ensuring equity of opportunity. This included reference to the need to improve women’s experiences of the workplace, alongside work to improve engagement in STEM education and training. Some suggested that a change of culture is required within STEM organisations and employers to support and reinforce education and training activity. This included reference to points such as flexible working and the gender pay gap.
- It was suggested that making it easier for industry to seek help and training on equality and gender impacts could be beneficial, and this was compared to the availability of assistance with environmental impacts.
- The role of SMEs in addressing equity of outcomes in STEM was seen as under-represented by the strategy. This included reference to a benchmarking toolkit for SMEs developed by Equate.

- The procurement process for STEM industry was highlighted as an opportunity to strengthen equality and diversity, to ensure businesses take this seriously. This included suggestions that companies should be required to demonstrate activities to address gender imbalances as part of the procurement process.

Several respondents felt that the Strategy's focus appeared to be on young people, despite acknowledging the need to address the whole pipeline. These respondents wished to see a greater emphasis on **adults engaging with STEM**. This included a particular focus on women returners to STEM and women transitioning from other careers. The need for support networks was highlighted for both groups, as was the role of STEM industry in developing individual's confidence to enable women to use the skills that they often have in place. Comments included reference to flexibility in funding to support retention of women in STEM industries, including a suggestion that Research and Development funding stops if women take a career break. Returners to STEM were also recommended as a potential focus to promote opportunities to enter education.

The role of **influencers of children and young people** was also highlighted by a number of respondents. Comments highlighted a need to change perceptions of STEM amongst parents and carers in particular. Some also referred more widely to the impact of media, and suggested a need for work on equity in STEM to be in the context of wider changes in societal attitudes.

Respondents also commented on **other specific actions and issues** which do not relate to a single sector or group:

- A number of respondents wished to see a stronger emphasis in the Strategy on training on gender equality and bias for all those who support and guide young people. This included embedding training as part of CPD for teachers, early years staff, lecturers and career advisers, and also included in training for new employees and leaders. A number of respondents referred to Primary Engineer's unconscious bias training
- Several respondents expressed concern that the perception of STEM often differs from the reality. This included reference to providing a better understanding to children and young people of what STEM means, including STEM skills and raising awareness of employment prospects. Some also suggested a need to modify language use to ensure fit between industry and education, and saw this as particularly important to facilitate young people's understanding of how skills gained through education can translate into career prospects.
- Some suggested that more investment is needed to ensure equal access across the country to STEM Ambassadors, and that gender equality training should be provided to all Ambassadors. Respondents also suggested a need for greater diversity of Ambassadors, with a particular focus on ensuring pupils can relate to individuals and that they can place their work in the context of the curriculum.

- Respondents also referred to the role of Modern Apprenticeships, suggesting that these could be better used as a pathway to employment including reference to a significant gender imbalance across schemes. A need to change perceptions of Modern Apprenticeships was also highlighted, to ensure all stakeholders recognise the range of career options that a Modern Apprenticeship can provide. A potential role for STEM Ambassadors was also highlighted here. It was also suggested that the strategy should include a commitment to increased take-up of Modern Apprenticeships by looked after young people and care leavers, and that the age threshold of 24 should be considered for example for women returners.
- The role of science centres was highlighted in terms of building STEM capital, including reference to outreach work and engagement with community learning and other community engagement providers. However, some suggested that cost can be a barrier to access to centres, and that the demographic of those using science centres and festivals could be more diverse.
- A university respondent expressed support for expanding the REACH project to include a wider range of STEM disciplines.
- A small number of respondents emphasised the role of arts in STEM, and suggested that the strategy should acknowledge the “STEAM” approach and potential for impact on gender equity.
- A small number of respondents suggested that the strategy should include clearer acknowledgement of the value of “STEM in action” – including the role of science centres, museums, outdoor spaces.
- The potential role of positive action was also referenced, while acknowledging that this must be well evidenced.
- Respondents suggested that consideration should be given to more single sex courses. These respondents referred to positive feedback from initiatives, although it was noted that more work may be required to assess their impact on gender equity in STEM subjects.
- An education sector respondent felt that the strategy should acknowledge the role of private sector education providers.

Contribution of education and voluntary sectors

Question 11 sought views on what education sectors, voluntary organisations and science engagement providers could do to support the areas for action identified in the draft strategy.

Q11. What could schools, colleges, universities, community learning and development, the voluntary sector, science engagement providers and museums do to support the areas for action?

A total of 157 respondents provided further comment at Question 11, 82% of all respondents. This included 104 group respondents and 53 individuals.

Respondents provided a range of views on approaches to be taken across these sectors. This included some reference to the four specific priority themes for action, but also wider points in relation to **the role of specific sectors**.

A substantial number of respondents referred to the role of schools as central to the strategy, with some suggesting that more could be done to integrate schools into the STEM agenda. Suggestions for bringing schools more closely into the STEM agenda included embedding STEM subjects into CfE, bringing STEM ambassadors into more schools, and intervention at early years and primary level and S1 and 2 to promote long-term interest over these subjects.

In relation to colleges, several respondents suggested that many colleges are already active in the area, including in engaging with schools on STEM and contributing to STEM partnerships. Respondents also referred to the work of a number of universities in establishing direct links with schools, science engagement and widening participation activity, and museums. Respondents also referred to plans for further work in this area.

Several respondents referred to community learning as a major component of extending STEM activity, although responses included limited detail on work across this sector. A small number of respondents suggested a need for this sector to be more integrated into the strategy.

A range of respondents gave a positive view of the role played by **festivals, science centres and museums** in supporting STEM areas for action. This included some suggesting a stronger role for these sectors in the strategy, including specific reference to museums. Respondents referred to a number of existing activities across these sectors:

- Large scale interventions such as science festivals, Children's University and national events such as National Science Week.
- Use of STEM professionals as advocates.
- Apprenticeship programmes.

- Widening Participation and clearer pathways for STEM students between educational sectors.
- STEM ambassadors working with various sectors.

The value of **coordination to ensure joined up activity across sectors** was highlighted by a number of respondents. Specific approaches suggested by these respondents included a shared strategy and approach across sectors, common points of access and dissemination, and provision of resourcing. Respondents also referred to a need to integrate sectors less prominently featured in STEM initiatives such as the voluntary, community and museum sectors.

A substantial number of respondents also saw a need for more joined up thinking, shared planning and resources across education sectors, STEM industries and public bodies within the “STEM ecosystem”. Several respondents referred to the potential to use funding structures to encourage and enable these collaborative approaches. Other specific suggestions to improve collaboration included:

- Improved articulation and pathways between colleges and universities.
- Building STEM engagement into research grants.
- National conferences for educators and STEM practitioners.
- Direct collaborations between teachers supported by adequate resources to buy out staff time.
- Linking to skills investments plans and other skills development initiatives (i.e. Energy Skills Partnerships).
- Regional agreements.
- Links to DYW groups.

Respondents also referred to **quality and benchmarking frameworks** to encourage more consistency in outreach and engagement work across all sectors. This include a suggestion for benchmarking to existing frameworks.

A number of **constraints** were identified in relation to current STEM work across sectors, and the potential for this to be further developed. Comments here related primarily to resourcing, although issues were also identified in relation to CfE implementation, bureaucracy and inconsistent messages from STEM organisations. Several respondents suggested that, while engagement and skills development/promotion activities were positive, these can be too narrowly focused and could be delivered to a wider array of schools – and across the curriculum. Some also suggested that programmes such as Engineering Science (at various levels) or Foundation Apprenticeships could be expanded and harnessed more effectively.

Respondents also raised a number of points specifically in relation to each of the priority themes. These are summarised below:

The main points raised in relation to **Excellence** were:

- The need to review professional development programmes to instil confidence and competence in STEM teaching – for example, providing Technological, as well as pedagogical CPD.
- Adopt approaches used in museum and science engagement initiatives and festivals across the sectors into an integrated cross-sectoral strategy.
- Better promotion of existing STEM pathways as provided by further and higher education.
- More evenly distributed STEM education – workshops, tasters and add-ons to the curriculum, in addition to higher-level master programmes and courses.
- Improving the quality of engagement through auditing, partnerships and sharing best practice.

The main points raised in relation to **Equity** were:

- More work to reach out to disadvantaged and peripheral communities, and specifically to females, through targeted initiatives.
- Moves towards gender equity needed to be holistic, for example on a whole school basis. Some suggested that could be linked to the Public Sector Equality Duty), the work of organisations such as EQUATE Scotland, and the Gender action Plan.
- Several respondents felt there needed to be a clearer message that STEM was for all classes, genders and ethnicities.
- Use of digital and online platforms was mentioned specifically in relation to improving equity in STEM, including geographic equity.
- Developing regional cross-sectoral strategies and pathways to ensure a greater spread of, and access to STEM expertise within the education system.

The main points raised in relation to **Inspiration** were:

- Working closely with local science festivals and events.
- More entry level and early years intervention in schools and community learning settings.
- Creating a network of larger and better resourced STEM centres, access points and institutes or science/engineering museums across Scotland.

The main points raised in relation to **Connection** were:

- A suggestion for a single body to coordinate STEM strategy across the various educational, engagement, museum and third sector providers.
- Colleges and universities providing CPD for schools through initiatives such as Q-STEP, and potential for STEM work placements for teachers. Early Years should be prioritised, and Community Learning Development Practitioners should also be included.
- Impact and engagement elements within HEI research funding programmes should embed STEM outreach activities.
- STEM should be embedded across curriculum areas.

Contribution of professional and representative bodies

Question 12 sought views on what professional bodies and third sector organisations could do to support the areas for action identified in the draft strategy.

Q12. What could professional organisations and bodies and third sector organisations do to support the areas for action? This includes, in particular, the General Teaching Council for Scotland, the CLD Standards Council, the teaching unions and representatives and the Learned Societies.

A total of 139 respondents provided further comment at Question 12, 72% of all respondents. This included 87 group respondents and 52 individuals.

These respondents identified a range of **areas where professional and third sector organisations could support the strategy**. The most common themes across these suggestions related to the importance of teacher training and CPD, and the need for coordinated sectoral and regional partnerships to join up efforts and apply consistent standards for STEM training and CPD. Resourcing was also highlighted by a number of respondents, including in relation to the STEM ambassadors programme; several respondents suggested that educators and organisations needed more support and access to get the full benefit of ambassadors' expertise. For some of these respondents, this appeared to reflect a broader concern that resourcing constraints were undermining delivery of the priorities identified by the strategy.

A substantial number of those providing comment referred to teachers' unions and representative bodies, and most of these respondents saw their role as central to the success of the strategy, particularly in regard to setting standards for teacher training and competence. However, a small number of respondents questioned whether these bodies were best placed to lead work in relation to STEM education and training. This included for example concerns around the portrayal of the sector as being a challenging one as having potential to affect morale and deter potential new STEM entrants into the profession.

Some respondents felt that the question implied an overly narrow range of professional and third sector bodies as having a role in supporting the strategy. This included several respondents highlighting the contribution being made by STEM industries, and suggesting a clearer recognition of their role in delivering the strategy. This included specifically in relation to a need for greater coordination at a regional level.

Respondents pointed to a number of **activities already being delivered by professional and third sector organisations**. This included partnership working, and work to embed STEM skills within entry to teacher training, with several respondents supporting this approach. Specific improvements and initiatives included:

- The use of summer schools and student placement schemes such as Q-Step, to upskill in STEM subjects.
- STEM industry led initiatives to change teacher's perceptions and promote upskilling.
- Reference to STEM organisations within the third sector having developed programmes that link to assessment agendas and criteria and could be mapped to the existing curriculum, or better promoted.
- The work of SSERC in providing high quality STEM CPD was acknowledged by a number of respondents.

In addition to these broader references, respondents also made a range of points in relation to each of the four priority themes. These are summarised below.

In relation to **Excellence**, responses focused primarily on quality control, and adequate supply of STEM-competent teachers. This included the following specific points:

- Ensuring new activities are approved and quality controlled by national, regional and/or cross-sectoral partnerships - including direct input from STEM industries.
- A focus on supplying STEM teachers into primary and early years education, and improving STEM skills and confidence levels.
- Draw on existing initiatives aimed at developing STEM within the roll-out of CfE.
- Embedding STEM across Initial Teacher Education and ongoing CPD, ensuring that STEM is a core aspect of teacher competence across all subject areas.
- Ensuring the best mechanisms are in place to encourage STEM partnerships between the various stakeholders, and that these can function and reach their full potential.

In relation to **Equity**, responses highlighted embedding of STEM training across subjects, and smarter working:

- Careers advice and student guidance needs to be given early, and with an emphasis on tackling gender stereotypes.
- Smarter, more targeted initiatives that build on existing good practice are needed to tackle gender equality in STEM and change perceptions of related careers.
- Geographic equity was identified as a particular concern for Scotland, with shortages in STEM teachers referenced in more remote parts of Scotland. Ensuring supply of STEM teachers across all regions was seen as particularly important.
- Several respondents referred to funding, support and intervention by learned societies as critical in providing resources to support STEM programmes and outreach.
- Reference to social barriers that affect STEM uptake, and the role of third sector and public bodies in training staff in education and social services to help their clients overcome these.

In relation to **Inspiration**, comments were focused on the capacity of teachers, and their performance as educators. This included reference to being able to bring pupils and students in touch with new developments in STEM, or ways of making STEM relatable:

- The ability of teachers to inspire interest and challenge perceptions of STEM was felt to be a core skill required of teachers across disciplines. In this context, a small number of respondents referred to a need to address the issue of underperforming teachers, particularly in relation to “hard to sell” areas such as STEM.
- Suggestions for providing inspiration included using the Scottish landscape itself, and using cutting edge research as a “hook” to engage children and young people in the potential of STEM projects.
- Access and awareness were seen as issues for this theme, including for example the ability of schools to access STEM related events and festivals.

In relation to **Connection**, respondents focused primarily on infrastructure and information flow. The main points were:

- Digital Strategies were seen as critical to this theme – existing national strategies and, potentially, new frameworks to support STEM through the most appropriate digital infrastructure.

- Digital careers were also felt to be an important factor in STEM development, with this workforce being particularly STEM dependent and potential for significant future demand for skills in this sector.
- There needs to be a better developed digital infrastructure to support the delivery of online courses and support mechanisms for STEM educators, and to disseminate the information we already have on successful STEM approaches.
- The use of social media to promote STEM - and gauge its impact – was raised as a key area for development.
- The flow of information on STEM should be more multi-directional –for example, making sure teachers are aware of the dynamics of the labour market and the skills gaps they are working to fill, using bodies such as unions to promote STEM directly to their members, and gaining better information on what is happening within sectors.

Contribution of science centres and festivals

Question 13 sought views on what science centres and festivals could do to support the areas for action identified in the draft strategy.

Q13. What more could science centres and festivals do to complement and enhance STEM formal education, to inspire scientists of the future, and to ensure their activities support those of the Scottish Government and its agencies.

A total of 149 respondents provided further comment at Question 13, 78% of all respondents. This included 97 group respondents and 52 individuals.

A number of common themes emerged across responses in relation to the role of science centres and festivals for the strategy. A substantial number of those providing comment gave a positive view of the work of science centres and festivals in promoting STEM, including ongoing outreach and engagement work. **Positive activities and initiatives** mentioned by respondents included:

- Partnerships and collaborations between science centres and STEM industries including for example the Energy Skills Partnership the Goconstruct initiative or Explorathon.
- Careers pathways and links to careers services were seen as an important area for science centres to be better involved. The Edinburgh International Science Festival's Careers Hive was mentioned here.
- Regional coordination of engagement work was also referenced and seen as an important element in delivering the strategy. This included reference to the Glasgow City of Science and Innovation partnership, and CPD

programmes provided by the Aberdeen Science/Aberdeen Biodiversity Centre.

The need for **national and/or regional coordination** of science centres was raised as an issue by around 1 in 10 of those providing comment at Question 13. This included several respondents suggesting that science centres should play a more central role in the strategy, with closer integration of science centres within the STEM element of the education system. A small number of respondents also suggested a potential role for a national science centre to which regional centres could be aligned and coordinated.

A substantial number of those providing comment referred to **barriers limiting access to science centres and festivals**, and particularly issues around funding, resources, and geography. This included specific suggestions that science centres should be supported to increase their schools outreach programmes through direct school visits or roadshows/festivals. Primary schools were identified as a particular focus here.

Resourcing and financial barriers were also highlighted by respondents, in relation to funding for science centres, and entrance costs for members of the public. Several respondents suggested a need for funding for these centres to be more stable and secure. This included a suggestion to encourage greater collaboration and cooperation between museums and science centres, including the potential for a single sector approach. In relation to entrance costs, a substantial number of respondents referenced the impact of this on access to science centres, including for economically deprived families and those in rural areas. One respondent noted that schools could also be disadvantaged in accessing science centres by minimum workshop numbers – it was suggested these could be relaxed or potentially removed.

A small number of respondents urged the Scottish Government to consider free entry to science centres. Other suggestions included investment into schools through public or public/industry partnerships to help sponsor science centre trips, and to shape provision.

Respondents also referred to the importance of **science centres and festivals outreach and engagement** work. Several respondents suggested that science centres and festivals could play a stronger role in the important tasks of inspiring and promoting interest in STEM. This included suggestions for competitions, and linking STEM work with initiatives such as Year of the Young person, Explorathon or Scottish Science Week. One respondent noted that this would allow different museums, festivals and events to share themes and ensure consistent messages.

The relationship between science centres and schools was seen as particularly important, and one that should be long term. Respondents suggested that science centre outreach should involve teachers more directly, and that consideration should be given to how the skills and concepts passed on through outreach work can continue after the event itself, so that it is not simply a “bolt on”.

Other suggestions aimed at embedding outreach included holding regular out of school clubs in science centres, online support for home learning and CPD support for educators – particularly primary teachers. The potential value of a forum to support dialogue between teachers and science centres or industry was also mentioned. A number of respondents mentioned the importance of digital platforms to enhance the accessibility of science centres and festivals - including ‘virtual science fairs’, teaching through apps and social media, and shared information portals. The potential for science centres and festivals to work with third sector organisations to provide community outreach with an equality focus was also referenced.

A number of respondents commented on the importance of outreach activities being relevant and placed in context. This included a desire to see more emphasis on potential careers in science centre outreach, perhaps through a more direct connection to careers services.

Several respondents emphasised the role of science centres and festivals in promoting family intergenerational STEM learning, and potential for targeting parents and families in encouraging their children towards STEM. This was seen as a means of promoting greater equity and aiding families with low ‘STEM capital’. The need to target science centre provision to boost female engagement in STEM was also mentioned.

Several respondents suggested a need for better systems of feedback and evaluation, including from young people involved in science centre visits and outreach. This included a suggestion for pupils forums to help shape engagement programmes.

Additional sector-specific actions

Question 14 sought views on what other sectors could do to support the areas for action identified in the draft strategy.

Q14. Should this Strategy identify more actions for particular sectors, for example in relation to workplace and work-based training and development?

A total of 121 respondents provided further comment at Question 14, around 63% of all respondents. This included 87 group respondents and 34 individuals.

These respondents referred to a broad range of sectors and specific bodies as having a contribution to make to the strategy. Comments also reflect respondents’ views on a broader strategic issues, and we summarise these below.

A number of respondents expressed particular support for a framework for **work based training and development**, at a national and regional level. This included suggestions that this framework should incorporate sectoral and employer level involvement, and should link to existing strategies and skills investment plans. A number of respondents also referred to the value of industry placement within

training and professional development for teachers. Other settings, such as STEM departments in universities were also suggested. Some respondents suggested that these training and upskilling opportunities should be extended to careers advisers and school technicians.

Also in relation to training and development, a number of respondents suggested that supporting those already in the workforce to retrain and move to STEM careers should be an important element of the strategy. Several respondents also suggested that a clearer assessment of skills gaps to inform prioritisation of sectors for development.

Respondents also referred to the role of **STEM employers as providers of training and development opportunities**. It was suggested that greater support was needed for this work, such as financial incentives and direct partnerships with education. This included specific reference to SMEs and micro businesses as potentially requiring more targeted support to enable them to engage in the strategy process. The role of STEM industries in providing work experience placements was also referenced by some respondents as a particularly important aspect of the strategy. Some respondents suggested that this should specifically include work placements as part of STEM study at schools and further/higher education.

Respondents also gave views on the types of training and outreach required. A number of respondents underlined the importance of apprenticeships, and several STEM industry respondents noted the value of Modern Apprenticeships, Foundation Apprenticeships and degree and Graduate level apprenticeships.

A number of respondents suggested that STEM sectors could be more involved in work to reach under-represented groups. Suggestions here included use of quotas and dedicated funding, and embedding of more inclusive policies across sectors. Comments here focused primarily on gender imbalances.

A substantial number of those providing comment at Question 14 referred to **specific STEM sectors**. These comments focused primarily on engineering; food, drink and hospitality; construction; healthcare; and digital sectors. The key points raised by respondents are summarised below.

The main points raised in relation to **engineering** were:

- Trade Union and Employer partnerships to deliver workplace training could provide a useful blueprint for elements of the strategy within this sector.
- A need for a stronger system of guidance towards engineering careers - including careers guidance, but also at a subject level for example through better links to schools physics courses.
- Civil engineering partnerships with education at school and college level are actions that should be linked to the strategy.
- More sector-specific, tailored approaches. For example some concern was expressed around the suitability of Foundation Apprenticeships for specific

engineering sectors due to safety requirements. The National Progression Award was felt to be a preferable option for some sectors.

- Trade associations should be partners in implementing the strategy.

The main points raised in relation to **food, drink and hospitality** were:

- Highlighting that STEM subjects are also important to the industry, and a desire to the strategy to ensure that STEM skills requirements are met.
- Awareness raising of the role of STEM skills across these industries was seen as an important area for action.

The main points raised in relation to **construction** were:

- Noting the relevance of STEM subjects and skills for the industry, and concern that these STEM skills requirements are met.
- It was pointed out that construction companies were often small in size and needed support and resources to develop STEM skills for their employees. Areas identified for this support included digitisation, automation, offsite manufacture, engineering and infrastructure.
- Reference was made to the Skills and Training Fund established by the CITB to support STEM training to small employers.

The main points raised in relation to **healthcare** were:

- A need to equip Staff with digital and STEM skills, including reference to the relevance of STEM skills within nursing and healthcare situations.
- Reference was made to NHS Graduate science training schemes.

The main points raised in relation to **digital sectors** were:

- Addressing skills gaps and presenting stronger careers pathways in digital industries, including links to earlier comments around placements as part of teacher training and development.
- Sectors such as healthcare and youthwork have an increasing use of digital technologies and need upskilling in this area.

The STEM Improvement Framework

The draft strategy proposed that a National STEM Improvement Framework is developed to provide early years, schools and clusters with a clear approach to improve STEM learning and teaching. A draft of the Framework is included as part of the consultation document.

Question 15 sought views on the proposal for a STEM Improvement Framework, and on how to ensure take up of the Framework.

Q15. Tell us what you think about this Improvement Framework. How can we best ensure uptake of this Framework in early years learning settings, schools and clusters?

A total of 134 respondents provided further comment at Question 15, 70% of all respondents. This included 87 group respondents and 47 individuals.

Most of those providing comment expressed some level of support for the Framework, with reference made to its principles as robust and setting out the correct vision for STEM improvement. However, a number of those expressing positive views nevertheless raised some issues or concerns around implementation – and the majority of respondents providing comment at Question 15 used their comments to raise issues or suggest amendment to the Framework.

For a number of these respondents concerns were focused on **implementation of the Framework**, including particular concerns for school and nursery level. This included reference to the Framework as “too general” to support detailed implementation. A small number of respondents also referred to the Framework as being too “top down”, and some suggested that the Framework may place a significant strain on capacity across sectors. This included a suggestion that schools and clusters should be challenged to evaluate and declare their own timeline for implementing the Framework, so that more achievable deadlines could be set.

Measurement of performance also emerged as a theme across responses. This included reference to a need to benchmark evidence from a common starting point, and that measurement of performance incorporates qualitative elements to provide a more accurate account of progress.

A number of respondents included more detailed comments on the content of the Framework, including suggested additions and deletions:

- Suggestions that links between the Framework to the overarching STEM strategy need to be clearer, and also the relationship to other relevant strategies.
- Some respondents felt the role of bodies such as the schools inspectorate should be made clearer, particularly in supporting school clusters to develop.

- A small number of respondents also suggested reconfiguring examination and assessment regimes to meet the needs of the Framework, including a potential role for The Scottish College of Educational Leadership in implementation.
- Refocus the framework from self-evaluation of individual institutions to one based on evaluating partnerships and hubs.
- The specifics of the implementation need to be fleshed out the Framework, and should include a 'spine' against which actions can be planned and enacted.
- Some respondents suggested that the STEM leads should perhaps be a full-time role, rather than an addition to an existing job.
- A number of respondents felt the Scottish Government should consider how many frameworks are in place, and how STEM relates to this – including for example, the National Improvement Framework. Some of these respondents felt the landscape could be simplified.
- The role of STEM ambassadors was noted, including suggestions that the programme should be promoted as a central part of the Framework.
- Consider matching the baseline to international benchmarks.
- The Framework should avoid allowing measures to lead activity and could for example include a set of hard and soft performance indicators.
- The use of 'named persons' was supported by some respondents, including some STEM industries. However, others raised concerns including calls for additional evidence to support the rationale for this proposal. It was also suggested that named persons should be supported with adequate training and resources, and that the aim should be for named persons in each primary school.

Suggested approaches to ensure uptake

Respondents raised a range of specific points in relation to uptake across sectors, and the measures that would maximise uptake in the target sectors. These are summarised below:

The main points raised in relation to **Early Years** were:

- There needs to be more of a focus on primary schools and early years, with early years STEM provision also focused on preparing children for the school curriculum.
- Professional learning for Early Years teachers needs to be brought out more clearly in the Framework.

- Learners should be exposed to STEM careers and what they involve at the early years stage - it was suggested that pathways into STEM should begin at this stage, and continue through to HE level.
- Expert and technical support should be provided locally, and when needed to early years educators was felt to be particularly important to ensuring uptake in early years education. This could also involve collaboration with secondary school teachers.

The main points raised in relation to **Schools** were:

- A number of respondents referred to the potential pressure a new Framework could place on the time and resources of schools staff. These respondents suggested that targeted support and funding would be needed to aid schools in meeting the challenges set out by the Framework.
- Several respondents referred to the value of external expertise for educators, including suggestions that this is based around long-term effects and relationships. Identifying innovation contacts for schools was also seen as essential to ensure their buy-in to the Framework and its successful implementation.
- Collegiate approaches across school and between education levels – such as teachers from secondary schools, universities or colleges working with early years counterparts.
- Some respondents felt that the Framework required a proactive approach to influence uptake by schools. These respondents suggested that buy-in from schools would be more likely if support was targeted towards middle management/administration, teacher workloads, and the role of carers.
- Teacher training and CPD was mentioned by a range of respondents as a key means of implementation and support for the Framework.

The main points raised in relation to **Colleges** were:

- Several respondents, and colleges in particular, suggested that the Framework emphasised early years and schools educational clusters, and suggested a stronger role for further and higher education, and community learning sectors. This included suggestions that colleges should engage more with primary education, and an example of STEM awareness days for primary school educators.
- Vocational training through apprenticeships, such as Foundation Apprenticeships or Graduate Apprenticeships, were areas where colleges could play a particularly important role.
- Several college respondents noted that they already play a role in collaboration and partnerships as STEM regional leaders. These

respondents encouraged further development of partnerships and hubs alongside the Framework.

The main points raised in relation to **Clusters** were:

- Respondents across a number of sectors wished to see clusters to be more inclusive, taking a community focused approach and bringing in, for example, out-of-school care settings, and parents/families. It was also suggested that rural clustering could be effective in addressing geographic inequalities.
- The Framework's commitment to equality and diversity was specifically welcomed by a number of respondents, although some suggested amendment to the scope and focus of this. This included suggestions that the focus on learner needs was too narrow and would not meet aim 3, and that the Framework should do more to acknowledge the complexity of equality issues, especially those that arise between sectors and the impact on teacher training. Embedding equality within performance measures was suggested here.
- Several respondents noted that existing practice within schools and academic clusters should be further developed. This included measures suggested for addressing equality and diversity, such as equality auditing of teaching materials and inclusion/embedding within CPD.

Collaboration

The draft strategy proposes a number of actions to be taken by the Scottish Government that will support all four priority themes. One of these is the development of a model of collaboration between schools, colleges, universities and employers. This will support cluster working, development of excellent teaching approaches and professional learning, and promote skills and resource sharing. The draft notes the range of existing centre and hub models in the UK and internationally from which learning can be drawn.

Question 16 sought views on the proposal for a model of collaboration, and on how this proposal should be take forward.

Q16. Tell us what you think of our proposal for developing a model of collaboration between schools, colleges, universities and employers. How should we now take this forward?

A total of 151 respondents provided further comment at Question 16, 79% of all respondents. This included 100 group respondents, and 51 individuals.

These comments indicate that the majority of respondents were **supportive of the principle of a model of collaboration**. Around 3 in 5 of those providing comment made explicit their support for the proposals, and comments from most other respondents implied support for the principle of greater collaboration. This included particular reference to aspects of the proposals which respondents felt would have a positive impact.

A number of those providing comment included reference to the importance of collaboration and coordination of action, discussed earlier in this report in relation to delivery of the strategy at Questions 7 and 8. Respondents suggested that the model should enable collaboration rather than create competition, recognising that multiple small competing interests is not productive. Respondents also referred to a number of existing partnership approaches having demonstrated the value of this approach, and suggested that there is growing recognition of this. At a lower level, respondents also referred to the depth of collaboration activity often on a case-by-case basis – the proposed model was seen as an opportunity to better harness this activity and goodwill to deliver better outcomes.

The importance of bringing together partners from across the full STEM pipeline was also highlighted as a particular strength. This included in relation to sharing of knowledge and (potentially) resources, aligning the education pipeline with skills requirements, and helping to demonstrate the diversity of opportunities available through engagement with STEM. This latter point was highlighted as of particular value to support transitions through schools, further or higher education, and work. Several respondents also saw the model of collaboration as a key opportunity to create more wide ranging and better coordinated approaches to tackling gender inequality.

The majority of those providing further comment at Question 16 raised issues, points for clarification, or suggestions for taking the proposals forward. This included a range of specific suggestions for the process of developing the model, and for the detail of the model itself. However, respondents also raised a range of **broader considerations that will need to be addressed** by development of the model. These are summarised below.

- The importance that the model is fully funded and resourced was highlighted by range of respondents across respondent types, including reference to the scale of resource used to establish international models such as LUMA. The issue of resourcing was highlighted particularly for the initial establishment of partnerships, with some suggesting that these should become sustainable over time. The potential role of Corporate Social Responsibility contributions from STEM industry was highlighted.
- A small number of respondents noted issues raised by teachers in relation to existing or proposed “LUMA style” approaches, and these included a particular focus on resourcing. Specific issues included lack of time within the curriculum for engagement work, a lack of teaching resources, the need for STEM engagement to complement the wider curriculum, and ensuring that all partners can see the value in collaboration and engagement.
- Resourcing was also raised for national and regional stakeholders, who may be expected to contribute across multiple regional partnerships. This included reference to the broad geographical reach of universities, and some questioned how local or regional partnerships will fit with the international focus of many universities.
- Several respondents suggested that the success of the model will be dependent on ensuring genuine buy-in to the collaborative model. This included reference to the importance of open communication across partners, and all involved recognising the contribution to be made by each partner. The latter point included references to ensuring that all schools within a cluster have an equal opportunity to participate.
- Several respondents suggested a need to consider potential barriers to participation for partnership in rural areas. This included reference to specific resourcing requirements for small schools with limited staff and resources.
- A science engagement respondent suggested that the issue of collaboration is already being considered by the wider Governance Review, and that it may be appropriate to wait for the outcome of the Review.

Some of those providing comment specifically addressed the process of **developing and implementing the model of collaboration**. This included a particular focus on ensuring that development of the model makes best use of existing structures and experience. This was most commonly raised in relation to ensuring a collaborative approach to developing the model which builds on existing collaboration activity (including reference to specific existing networks that could be used to pilot the approach). Several respondents highlighted the importance that development of the model can draw on the right kinds of knowledge and expertise, including some who recommended input from Innovation Centres to inform the development process. The importance of the collaborative approach was also related to some respondents suggesting that existing examples can miss one or more partners, and that a collaborative approach to development can ensure all are able to contribute.

Several respondents referred to similar models elsewhere in the UK and internationally, and the potential to draw on learning from these. However, it was also noted that some learning points may not be applicable to the Scottish context, dependent on the wider education and social context to assess.

Also related to existing collaborative working, a small number of respondents suggested potential value in mapping the broad range of current activity. These respondents suggested that this kind of exercise can inform development of the model for example by identifying areas of duplication or gaps in provision.

Several respondents suggested that there is a need to specify a clear purpose and set of objectives for the model, and for individual hub/clusters. This included some reference to previous experience having highlighted the importance of a clear objective to activity, and to enable partners to see the value of the model.

A STEM industry respondent noted the importance of implementation proceeding rapidly, reflecting a view that there is a pressing need for the resource.

Finally, respondents raised a range of more **specific points on the detail of the model**. This included some difference of views on how to balance the regional focus of partnerships, and a nationally coordinated approach. A number of respondents, across various respondent types, agreed with a regional approach to encourage key players to work together and coordinate initiatives with a focus on learner pathways and career choices. This included recommendations that a “bottom-up” approach is needed that recognises that different approaches may be required across the country. However, others noted that there needs to be a consistent national approach to STEM education and training, within which regional approaches can sit. This was highlighted as particularly important in the context of ensuring better connected approaches and minimising duplication. Also in relation to balancing the regional and national view, a science engagement respondent cautioned that the focus on a local or regional STEM industry should not occlude the wider (including international) opportunities that may be available to those engaged with STEM.

In addition to these issues, respondents also made a range of specific recommendations for the model for collaboration:

- The most common points raised by respondents related to existing partnerships or networks that could make a contribution to the model – or potentially for the basis of the model. This included reference to Developing the Young Workforce groups, Scottish Schools Education Research Centre (SSERC), Science Centres, other centres or hubs with a STEM education focus, the STEM Ambassadors programme, STEM Insight Initiative, and Teacher Education Partnerships.
- Several respondents expressed strong support for improving and expanding engagement with employers – although this included suggestions that work is needed to reach out to employers who are not currently engaged. Specific suggestions included setting up “Peer Networks” to which STEM industry can be invited, and developing clusters where schools and employers can work together. A proposal for an employer portal to support engagement with STEM provision was also suggested.
- Respondents highlighted a range of specific groups who they wished to see included within the scope of the collaborative model. These included means of including pupils and their families early years providers, representative bodies and trade associations, economic development organisations, community learning providers, training providers, and the third sector.
- Several respondents referred to a need to identify lead staff for key partners within each partnership – including for example from each school, university and college, and a leading industry STEM Ambassador.
- The need for physical classroom and laboratory facilities for each partnership was also highlighted - to act as a base for activities delivered through the partnership, and to provide schools with access to facilities that they may not have.
- Several respondents suggested that there is a need for a central online hub and information source to bring together available resources and information on engagement activity. This included a specific proposal for an employer portal to support ease of access to STEM provision.

STEM Ambassadors

The draft strategy includes proposals for a Scottish STEM ambassador network, building on the current STEM ambassador programme to provide all schools with the opportunity to develop partnerships with public, private or third sectors to improve STEM teaching and learning and STEM engagement. This will include promotion of peer-to-peer mentoring and support. The draft also noted that, in addition to current STEM ambassadors, the proposals would also draw on other relevant programmes including the Modern Apprenticeships Ambassador programme and local peer-to-peer mentoring initiatives.

Question 17 sought views on the proposal for a Scottish STEM ambassador network, and on how this proposal should be take forward.

Q17. Tell us what you think of our proposals for a Scottish STEM ambassador network. How should we now take that forward?

A total of 148 respondents provided further comment at Question 17, 77% of all respondents. This included 104 group respondents, and 44 individuals.

Around a third of those making comment expressed broad support for the proposals, including reference to positive experience of existing STEM ambassadors programmes, recognition of the value provided by ambassadors, and support for extending opportunities to engage with ambassadors. However, the majority of those providing further comment at Question 17 raised concerns or points for clarification, or suggestions for taking the proposals forward.

Respondents raised a number of **concerns or points requiring clarification** for proposals. This included around a third of those providing written comment who raised questions around how proposals relate to the multiple existing STEM ambassador programmes, and the volume of STEM initiatives more widely. The key concerns for these respondents appeared to be a lack of clarity around what an additional Scottish network will add, concerns regarding duplication of effort, and the potential to add complexity and confusion to STEM engagement. This included some suggestions that the range of existing ambassador programmes already cause some confusion for schools. Several respondents also referred to potential for confusion and/or resistance from STEM industries if proposals are seen as additional requests for support - particularly for UK-wide companies who may be required to work with multiple programmes. It was clear that, for some respondents, these concerns undermined support for the principle of a more comprehensive STEM ambassador programme.

Related to these concerns, a substantial number of respondents suggested that the objectives for the proposed new network could be pursued through existing programmes. This included recommendations that additional resources are provided to expand provision to fill geographic gaps, and to improve the range of ambassadors.

Respondents raised a number of other concerns or issues for proposals. Resourcing an expansion of STEM ambassadors across Scotland appeared to be the most significant of these. Several respondents referred to the logistical challenges of assigning ambassadors to every school across the country, in terms of resourcing but also maintaining the quality of ambassadors and a consistency of approach. Respondents also suggested that organisational support to establish and maintain partnerships has been vital to the success of existing STEM ambassador programmes, and that resourcing restrictions have been the key factor in any limitations in the effectiveness of existing programmes.

A small number of respondents suggested that STEM industry ambassadors give a very specific view of potential career pathways, and cautioned that ambassadors should not be the only way in which children and young people are given insight into STEM fields.

In addition to the above noted concerns, respondents also referred to a range of **considerations that should inform the approach** to the Scottish STEM ambassadors network. The key considerations raised by respondents were:

- The importance of learning from and linking with existing ambassador programmes, and other engagement work. A range of respondents referred to the knowledge and experience of specific organisations and groups as a resource to inform the development of the network. This included suggestions that current STEM ambassador hubs in Scotland are involved in development of any new network. Respondents also referred to the importance of how the new network is presented in relation to existing programmes to minimise confusion around how the programmes relate to one another.
- Coordination of the network was also highlighted in the context of ensuring it adds value to existing programmes, and to avoid duplication and confusion. This included some concerns that a peer-to-peer approach can lead to gaps in provision, for example where ambassadors move on. Several respondents recommended that a central coordinator role is included in the design of the network. In addition to concerns around coordination, the importance of flexibility was also noted. A university respondent suggested that the network must recognise the different challenges and needs across the country, and enable the approach to be tailored at a local or regional level. Related to the need for flexibility, several respondents referred to the particular challenges of establishing a network in rural areas – for example in terms of travel time and costs. This included previous experience of STEM ambassadors in rural areas, suggesting that most ambassadors were only able to engage with a limited pool of schools.
- A STEM industry respondent suggested a need to raise the profile of the ambassador programme to maximise take-up and reach. This included a suggestion for creation of a “Chief STEM Adviser” to raise the profile and status of ambassadors.

- A small number of respondents referred to evidence suggesting a link between involvement in the STEM ambassadors programme, and subsequent entry to STEM education. These respondents suggested that consideration is given to the role of the ambassadors programme in promoting teacher recruitment.

Respondents made a broad range of **specific points on the detailed approach** to a Scottish STEM ambassadors network. These are summarised below:

- A small number of respondents recommended that potential STEM ambassadors (including education and private sector candidates) and potential users of the network, should have a role in determining the overall approach. This included for example in relation to the role of ambassadors, and how the network is organised to ensure the approach is sustainable.
- A number of respondents highlighted the importance of STEM ambassadors being relatable to children and young people, including some who saw a “gulf” between the expertise of some ambassadors and pupils’ perspective. This also included suggestions that the “level” of ambassadors should be tailored to the audience, and the importance of identifying more female ambassadors. Another STEM education and professional/representative body also suggested that a “youth ambassador” element is introduced to the programme, enabling upper secondary pupils to assist in early years and primary transition.
- Ambassadors being provided with appropriate training and support was also seen as significant for the success of the network. This was particularly in relation to developing skills in engagement and learning techniques. Respondents also noted the need for ambassadors activity to be better aligned with the wider curriculum. This included reference to providing ambassadors with a clearer understanding of the curriculum. Respondents made reference to ongoing work to improve this that could feed into the new network, including for example a new STEM ambassadors contract in Scotland making a stronger connection between training and SSERC.
- The importance of identifying ambassadors across a range of sectors was raised by a substantial number of respondents. This included a particular focus on more direct engagement with STEM industries to identify ambassadors. Respondents again noted the need for resourcing to enable this broader reach - several respondents suggested that there may be sufficient interest to expand the range of individuals acting as ambassadors, but that a lack of support has been a barrier. Supporting small and medium enterprises to engage was seen as a particular issue requiring additional resources. Specific approaches suggested to expand the diversity of ambassadors included ensuring engagement through the ambassadors network is recognised as an element for staff CPD in STEM industries, and investigating potential to access discounted travel for ambassadors. A small number of respondents also suggested a potential role for the Chief Scientific

Adviser and/or innovation centres in promoting dialogue and encouraging engagement across sectors.

- Respondents identified a range of specific sectors and groups as requiring stronger engagement with the STEM ambassadors programme. This included a need for better representation of the STEM industry across the pool of ambassadors (and the importance of demonstrating the value of the programme to STEM industry); small and medium enterprises; increasing the number of female ambassadors and others from less well represented groups, although a small number of respondents noted the need to ensure this does not negatively impact their studies or career; ambassadors who have taken “less conventional” pathways into STEM, for example later life learners, former apprentices, and business entrepreneurs; and third sector organisations.
- A number of respondents referred to a need for more support to industry and schools in rural areas, to enable them to engage with ambassadors. Respondents also suggested a need to tailor the approach in these areas, for example identifying STEM ambassadors from those involved in STEM within the local area such as industry and further and higher education students.
- Several respondents noted the potential for digital technology to supplement the network. This included proposals for an online hub providing information and advice to support development of collaboration arrangements, coordinate ambassadors’ activity, and to share practice. Respondents also noted the potential for digital communication to extend the impact of the network for more dispersed rural areas, although several respondents noted the limitations of this approach, including for example connectivity within schools.
- A local authority respondent suggested that there is a need for the network to enable more meaningful, long-term partnerships with ambassadors, for example rather than “dropping in” to deliver standalone engagement sessions.
- Several respondents highlighted the value of coaching and mentoring approaches as part of the ambassadors approach. This included reference to a range of organisations involved in mentoring work.

Partnerships

The draft strategy details the range of agencies expected to drive the strategy forward at a national level, but also notes the need to maximise existing and identify new partnerships to support the strategy. In this context, the consultation included a final series of questions around the contribution that employers and others can make to delivery of the strategy.

Involving others in delivery of the strategy

Question 18 sought views on the range of organisations and people that should be involved in delivery of the strategy:

Q18. What other groups, organisations or people need to be involved in delivery of this strategy?

A total of 125 respondents provided further comment at Question 18, 65% of all respondents. This included 92 group respondents, and 33 individuals.

Consistent with the emphasis on engagement and collaboration in responses to Questions 16 and 17, respondents referred to a broad range of groups and organisations as having a potential role in delivery of the strategy. This included some respondents of the view that the strategy covers the key sectors and stakeholders to be involved in delivering aims and outcomes, and it is notable that some of the specific organisations mentioned by respondents are already referenced in the draft strategy.

In terms of specific groups and people mentioned by respondents, the main sectors and types of organisations were:

- **STEM industry** and industry professional and representative bodies;
- **Education sectors** including institutions across sectors, teachers and other educators, and professional and representative bodies;
- **Others involved in learning and skills development**, including training providers, standards and accreditation bodies, and organisations with a focus on careers advice and recruitment;
- **Academic and research** bodies;
- **STEM engagement schemes** with reference to a range of specific initiatives, including individual STEM ambassadors;
- **Science engagement** organisations including science centres and festivals;
- **Third sector** bodies including those with a particular focus on equalities;

- **Public bodies** including local and national government, and other public sector organisations including funding bodies; and
- **Young people and parents** including representative groups, and the wider community.

The table below lists the specific organisations and people mentioned by respondents at Question 18.

Question 18: Specific groups/organisations to be involved in delivery

Organisation type/name	Organisation type/name
Addictions Support & Counselling	Hunter Foundation
AGR Scotland	iChemE
Association of Directors of Education in Scotland	Institute of Physics
Association of Graduate Careers Advisory Services Scotland	Institution of Engineering and Technology
Association of Parental Councils	Kilmarnock Engineering and Science Society
Association of the British Pharmaceutical Industry (ABPI)	National Science Learning Centre
BioIC	National Physical Laboratory
Botanic Gardens	National Union of Students
BP Student Tutoring	NHS
Building Engineering Services Association	Public Engagement with Research Unit
Building Science Capital	Research Councils UK
CBI	Royal Botanic Garden
CH2M	Royal Society of Chemistry
CLD standards council	RSPB
Construction Industry Training Board	Science and Technologies Facilities Council
COSLA	Science Skills Academy
Developing the Young Workforce regional groups	ScienceGrrl
Development Trust Association Scotland	Scottish Aquaculture Innovation Centre
EDF	Scottish Children's Parliament
Edinburgh and Lothians Collaborative Hub for Care-Experienced Learners	Scottish Council for Development and Industry
Edinburgh International Science Festival	Scottish Electrical Charitable Training Trust
Edinburgh Zoo	Scottish Natural Heritage
Education Endowment Foundation	Scottish Schools Education Research Centre
Education Scotland	Scottish Science Advisory Council

Organisation type/name	Organisation type/name
Engineering Development Trust	Scottish Seabird Centre
Engineering UK's Tomorrow's Engineers	Scottish Wildlife Trust
Entrepreneurial Spark	Semta
Equality Challenge Unit	SEPA
EQUATE Scotland	SQA
Famelab	TechFest
Field Studies Council	The Smallpiece Trust
Forestry Commission	WISE
Founders4Schools	Young Engineers and Science Clubs Scotland
Gates Foundation	Young Scot
Glasgow Science Centre	YouthLink Scotland

Respondents' activities that support the strategy

Question 19 asked respondents to detail the range of activities they are current undertaking that support the strategy's aims and priorities.

Q19. Tell us about what you are doing in your organisation, establishment or community that supports the aims and priorities of this Strategy.

A total of 130 respondents provided further comment at Question 19, 68% of all respondents. This included 86 group respondents, and 44 individuals.

These respondents described a considerable volume of recent, current and planned activity that supports the strategic aims and priority themes – including some providing detailed accounts of ongoing initiatives and programmes. Actions referenced by respondents included some of those noted in the draft strategy, but respondents expanded on these to include a broad range of activity across sectors.

This activity was typically focused around broad areas such as supporting STEM learning and teaching, partnership working, STEM engagement, vocational pathways and working with the STEM industry, and actions with a specific focus on equality. However, while the broad areas of activity were similar, the specific initiatives and programmes mentioned varied across respondent types. Over the following pages we provide a brief summary of the key areas highlighted by each respondent type.

Q19: Activity that supports the Strategy

Schools, colleges and universities

Learning and teaching	<p>A broad range of STEM-related programmes including courses and “boot camps”; raising awareness of STEM pathways; courses for STEM returners; promoting STEM skills across non-STEM disciplines; development of transferable study skills; “STEAM” programmes promoting the role of arts in STEM; development of digital skills including e-learning.</p> <p>Teachers CPD with a STEM-focus.</p> <p>STEM in the outdoors including provision of CPD, development of “nature pedagogy”.</p> <p>STEM-related awards and recognition for students including academic awards and “Olympiad” competitions.</p>
Partnerships	<p>Contributing to STEM partnerships, advisory groups and sharing of good practice; identifying STEM “champions”; supporting development of additional STEM facilities and programmes; research partnerships to provide STEM research experience; STEM-based events for parents and carers; international partnerships.</p> <p>Developing STEM-related policy and strategy.</p>
Outreach and engagement	<p>STEM outreach and engagement, primarily to schools, and including partnership working across sectors. Specific approaches included taster sessions in schools including use of digital tools; supporting STEM clubs and other extra-curricular arrangements; summer schools; supporting students as STEM Ambassadors; employability sessions; wider STEM engagement including providing open access to “science centre-like” facilities.</p>
Vocational pathways and industry	<p>Development of STEM academic and vocational pathways including employability and careers pathways.</p> <p>Engagement with STEM industry and professional bodies including industry placements for students; STEM Apprenticeships; pre-Apprenticeship work; providing STEM training and CPD to industry; contributing to the Developing the Young Workforce programme.</p>
Equality	<p>A range of STEM activity with a specific equality focus including working with Equate and other third sector organisations to improve equality across education sectors; gateway programmes to facilitate entry to STEM courses for disadvantaged groups; programmes to raise attainment and aspirations for disadvantaged groups; work to improve gender balance including a focus on specific disciplines and courses; positive action; increasing diversity of workforce; review of marketing materials for gender bias; unconscious bias training.</p>

Academic/research institutes

Learning and teaching	<p>STEM-related courses; summer project placements; mentoring support, providing STEM-related professional learning and CPD.</p>
Partnerships	<p>Contributing to STEM partnerships, supporting joint working and planning, sharing of good practice.</p>
Outreach and engagement	<p>STEM outreach and engagement through schools, colleges and universities, and with communities including mentoring; STEM engagement programmes and events; engagement with teachers.</p>
Vocational pathways and industry	<p>Engagement with STEM industry and professional bodies including provision of Modern Apprenticeships; support for paid internships; operating STEM Ambassadors schemes and providing ambassadors; facilitating events and networks and sharing of practice, providing STEM-related professional learning and CPD.</p>
Equality	<p>Modern apprenticeships for care leavers.</p>

Science engagement

Learning and teaching	Engaging with the teaching profession to develop educational programmes, providing STEM experiences in schools
Partnerships	-
Outreach and engagement	Raising awareness of STEM including for example through science festivals and other high-profile events; providing learning experiences, summer camps and activity breaks; events tailored to support young people aspiring to a STEM university course; links with STEM Ambassadors; STEM-related awards and recognition; providing outdoor STEM engagement experiences.
Vocational pathways and industry	Engaging with research and industry to inform design of education and development programmes; involving industry in delivery of STEM outreach engagement.
Equality	Adopted school programme for those in remote areas, those in disadvantaged areas and those with additional support needs.

STEM industry

Learning and teaching	Contributing to CPD for teachers.
Partnerships	Contributing to STEM partnerships and professional bodies; providing research and evidence input to policy development; sponsorship of STEM partnerships, festivals and events.
Outreach and engagement	Contributing to Developing Young Workforce groups; working with the STEM Ambassadors programmes including supporting staff to become ambassadors; building ongoing relationships with schools and further/higher education; working with science centres to develop education programmes; providing programmes of STEM engagement and activity; outreach activity with a specific focus on developing digital skills; mentoring of school pupils.
Vocational pathways and industry	Recruitment of workforce through apprenticeships (including reference to Modern Apprenticeships and Graduate Level Apprenticeships) and other vocational pathways; maintaining work experience programmes; using open days and careers events to improve understanding of STEM career pathways; providing STEM training and development to employees.
Equality	Supporting women returners programmes; supporting women-focused STEM societies and organisations; contributing to STEM events with a specific equality focus; providing gender training to STEM ambassadors.

Education and professional/ representative bodies

Learning and teaching	<p>Contributing to the development of vocational programmes and qualifications; promoting STEM through Professional Recognition for teachers; refreshing teachers' professional standards accreditation of ITE courses to ensure a focus on numeracy; provision of accredited teacher CPD; providing teachers with placement experience in universities or STEM industry; engagement and support to new STEM teachers on PGCE courses.</p> <p>Providing accreditation to STEM-related education; developing education programmes with a specific focus on digital skills; supporting learning and teaching of STEM in schools, including providing access to STEM resources and teaching materials.</p> <p>Providing programmes across education sectors to improve careers education and wider understanding of STEM careers pathways; funding of PhD studentships.</p>
Partnerships	<p>Contributing to STEM partnerships and professional bodies, providing research and evidence input to policy development, facilitating sharing of information and practice.</p>
Outreach and engagement	<p>Establishing STEM hubs to facilitate engagement across schools; representation on Developing Young Workforce groups; providing STEM Ambassadors programmes and providing/supporting ambassadors; building ongoing relationships with schools and further/higher education; providing programmes of STEM engagement and activity including residential programmes, programmes giving students opportunities to engage in research; programmes to encourage uptake of more specialist STEM skills, outreach activity with a specific focus on developing digital skills.</p>
Vocational pathways and industry	<p>Producing professional standards and associated frameworks for apprenticeships and quality assurance of apprentice providers; providing work placements and project-based experience of STEM industries; participating in schemes to provide grants for work experience; providing programmes to promote and support employability and career progression; providing STEM industry with resources to support CPD and STEM engagement; providing STEM-related CPD across industries; providing funding to industry to support innovation.</p>
Equality	<p>Working with third sector bodies to develop and promote equality-related approaches; supporting networks and groups with a specific focus on addressing inequality in STEM; projects with a specific focus on gender inequality and stereotyping; programmes to provide STEM opportunities to young people not in training education or employment; need for better representation of disadvantaged groups highlighted equality outcomes.</p>

Local authorities and other public bodies

Learning and teaching	<p>Provision of STEM-focused CPD for teachers; corporate STEM team to develop and provide CPD opportunities and STEM programmes; STEM coordinators in schools and secondments to lead improvements in STEM numeracy networks and “champions”; developing guidance on teaching of numeracy and mathematics.</p> <p>Ensuring all learners have access to STEM programmes and experiences; programmes around primary to secondary transition; digital skills and computer science programmes; S6 science ambassadors supporting provision of STEM education at primary level; programmes for pupils at upper secondary stages with a particular focus on career progression and employability; strategic promotion of Foundational Apprenticeships; raising awareness of labour market intelligence across schools; STEM competitions and events across schools; programmes to encourage family participation in science homework.</p>
Partnerships	<p>Maintaining strong links and engagement with further and higher education sectors; community learning and development partnerships with a STEM focus.</p>
Outreach and engagement	<p>STEM events and festivals; extra-curricular STEM clubs; engagement with Developing the Young Workforce teams; identifying and supporting STEM ambassadors; programmes to raise STEM awareness as part of major infrastructure projects, such as engagement opportunities for teachers and pupils; Digital Learning and Teaching conference.</p>
Vocational pathways and industry	<p>Provision of vocational pathways including apprenticeships and graduate networks to recruit and develop STEM talent ; skills investment plans, use of community benefit and social responsibility clauses with suppliers in STEM sectors.</p>
Equality	<p>“Girls into STEM” programmes; working with third sector and others on gender balance.</p>

Third sector/Non-profit organisations

Learning and teaching	<p>Providing STEM engagement and education programmes across schools; supplying free STEM resources to schools and funding schools’ purchase of equipment; provision of CPD and other programmes with a particular focus on improving STEM skills and confidence for teachers, and with progression routes to accredited qualification; campaigns focused on the quality of STEM education.</p>
Partnerships	<p>Working in partnership with local authorities, education sectors and other partners.</p>
Outreach and engagement	<p>Running STEM events and festivals to raise awareness and engagement; developing resources to improve parents’ awareness of STEM career options.</p>
Vocational pathways and industry	<p>Work with industry to identify economic growth sectors and skills gaps – and develop resources and events in response to these; collaboration with STEM industries to provide STEM education programmes; funding providers of CPD across STEM industries.</p>
Equality	<p>Working to identify and challenge gender stereotyping and unconscious bias; managing STEM industry-funded schools programme with a focus on gender; supporting women’s retention and progression in STEM through CPD and access to STEM networks; engaging with industry to identify and remove barriers to women in STEM; running programmes to encourage and recognise commitment to advancing the careers of women in STEM, including a specific focus on support for trans staff and students; providing educational and networking opportunities for women in digital technologies, including programmes with a particular focus on entrepreneurship and business startups; provide mentoring and support to women in STEM apprenticeships and employment; support to disadvantaged young people through inspirational STEM programmes, development of STEM skills and employment programmes; working with local authorities to identify schools in rural and deprived areas as a focus for engagement.</p>

Employers attracting and retaining more diverse STEM talent

The final consultation questions sought views on how employers could attract and retain more diverse STEM talent.

Q20. What could employers do to attract and retain more diverse STEM talent?

A total of 130 respondents provided further comment at Question 20, 68% of all respondents. This included 86 group respondents, and 44 individuals.

Respondents referred to a wide range of approaches that employers could use to improve the diversity of their STEM talent. This included reference to current activity which could be expanded, and new approaches which respondents felt are not used by enough employers. Broadly, these suggestions focused around work to raise awareness of the diversity of STEM careers and to provide more opportunities for children and young people to experience the sector, practices to ensure recruitment is more inclusive of those from disadvantaged backgrounds, and ensuring employers can retain more diverse talent. We highlight the main points in relation to each of these areas in turn below.

In relation to raising awareness of and engagement in STEM industries, most of those providing comment referred to the value of **employer engagement with education sectors and other partners**. A substantial number of respondents wished to see an expansion in employers' outreach engagement with schools, and with further and higher education. This was highlighted by a range of respondents including a number of colleges and universities, STEM industry and industry professional/ representative bodies, other STEM education and professional/ representative bodies, and third sector respondents. These respondents suggested that engagement provides significant benefits in terms of ensuring the education pipeline fits industry needs, improving understanding of what a career in STEM can involve, providing role models for potential STEM employers, and changing pupil (and teacher) perceptions of career pathways. An academic/ research institute also noted the potential benefits of engagement with further and higher education sectors in establishing pathways to ensure highly skilled graduates are not "lost" to the sector.

Greater employer engagement through STEM hubs and promotion of STEM ambassadorships was the main focus for most of these respondents, with some also referring to the benefits of a wider approach to enabling potential employees and their families to engage with employers. This included the role of science centres as a forum to change perceptions and supporting STEM engagement. Respondents referred to scope for expansion in this kind of engagement across STEM sectors, although some suggested that that this is particularly the case for "traditional" STEM industries.

As was noted in relation to STEM ambassadors at Question 17, several respondents highlighted the need for employers to provide those engaging with education sectors with the skills and resources to do so.

The other key area highlighted by respondents in relation to providing more opportunities for the future workforce to engage with the sector was expanding participation in **apprenticeship programmes and workplace experience**. This was a particular recommendation for colleges and universities, and some STEM industry professional/representative respondents. The value of ensuring these workplace experiences are meaningful was highlighted, including consideration of developing embedded and accredited placements, and the potential role of paid placements. The potential role of financial incentives such as sponsorship in attracting a more diverse set of applicants was also mentioned. Several respondents also noted the value of mentoring, and its potential, for example, around easing the transition into work.

Several respondents also specifically highlighted scope to make better use of apprenticeships – including the Foundational Apprenticeship, Modern Apprenticeship, and Graduate Level Apprenticeship. Respondents also referred to a need for clarity from the Scottish Government around use of the Apprenticeship Levy, and noted that HMRC is offering tax incentives for apprenticeships.

Respondents highlighted the importance of ensuring **recruitment approaches reach those from disadvantaged backgrounds**, with a number of respondents suggesting that employers could do more here. The importance of recruitment processes being as inclusive as possible was highlighted by several education sector and science engagement respondents. This included reference to avoiding stereotypes and addressing unconscious bias, and being conscious of language use. Several respondents suggested that employers would benefit from specialist advice and support in this area.

The need for recruitment to be aware of and responsive to disadvantage was also mentioned by some. This included specific reference to gender, economic deprivation, disability and care leavers. These respondents mentioned a range of potential strategies and approaches, and the availability of good practice and expertise to support employers was noted. Providing role models from a diversity of backgrounds was mentioned as a particularly effective approach, including for example via STEM ambassadors and other engagement approaches. Several respondents also suggested a potential role for financial incentives to attract and support candidates from disadvantaged groups, including through Apprenticeship programmes. Specific recommendations included sponsorship or scholarships, and writing off student debt. A science engagement respondent also mentioned a need for employers to consider entry requirements, and for example how these assign value to academic and vocational routes. A third sector respondent suggested that employers consider use of positive action, and referred to availability of advice and support for this.

The final element mentioned by respondents focused on approaches to **retaining STEM employees**. Changes to the workplace culture were the most commonly mentioned area here, including comments from respondents across all respondent types. The focus for these respondents was on employers providing a more flexible, inclusive and family-friendly culture. This included concern around the number of employees lost to the STEM sector due to poor working conditions, poor training and a lack of opportunities for progression. Awareness of the potential for unconscious bias and stereotypes was referenced, including provision of unconscious bias training. Respondents referred to a number of agencies as having a particular contribution to make here including Equate Scotland, professional bodies, and reference to research and good practice guidance. Respondents also suggested a need for greater flexibility in the workplace, including, for example, around career breaks and support to returners to STEM, and support for carers.

Remuneration and terms and conditions were also referenced by a number of respondents including education sector, science engagement, local authority, third sector and individual respondents. These respondents suggested a need to ensure remuneration reflects employees' value, and crucially is competitive with other sectors to ensure that employers are able to attract the talent required. Several respondents also referred to a need for greater transparency in pay, particularly in relation to addressing the gender pay gap.

A number of respondents suggested a need for a stronger focus on professional development and learning for employees, including ensuring that opportunities are responsive to employee interests and aspirations. More widely, several respondents referred to a need to identify talented individuals and assist their development including, for example, via secondments. The importance of ensuring clear career pathways are in place was also referenced in relation to enabling STEM talent to progress. A STEM industry professional/representative respondent also noted a need for employers to recognise the value of retaining graduate employees during economic downturns, given the investment made in employees through induction and CPD.

Several respondents referred to a need to ensure equal parity of esteem to academic and vocational routes. This was linked to comments earlier around promoting use of placements. These respondents also referred to a need to shift the focus from always recruiting the highest qualified graduates, and committing more resources to quality induction and training.

The final element mentioned in relation to retaining employees was recognition of achievement. This included reference to examples of use of awards or certification for STEM employers, including those with a particular focus on specific disadvantaged groups to give these employees greater status and presence.

Annex 1: Group Respondents

Respondent	Respondent Type
City of Glasgow College	Education sector - Colleges
Fife College on behalf of Fife STEM Strategy Group	Education sector - Colleges
Forth Valley College	Education sector - Colleges
George Watson's College	Education sector - Colleges
Glasgow Clyde College	Education sector - Colleges
Glasgow Kelvin College	Education sector - Colleges
North East Scotland College	Education sector - Colleges
Perth College UHI	Education sector - Colleges
West College Scotland	Education sector - Colleges
West Lothian College	Education sector - Colleges
Edinburgh Napier University	Education sector - Universities
Heriot-Watt University	Education sector - Universities
The Open University	Education sector - Universities
The University of Edinburgh	Education sector - Universities
University of Aberdeen	Education sector - Universities
University of Dundee	Education sector - Universities
University of Edinburgh Chair of Chemistry	Education sector - Universities
University of Glasgow	Education sector - Universities
University of St Andrews	Education sector - Universities
University of Strathclyde	Education sector - Universities
University of the Highlands and Islands STEM Team	Education sector - Universities
Mindstretchers	Education sector - Schools/Other
Musselburgh Burgh Primary School	Education sector - Schools/Other
Science Skills Academy	Education sector - Schools/Other
Trinity High School (Science Department)	Education sector - Schools/Other
Whizz Education Ltd.	Education sector - Schools/Other
Workers Educational Association (Scotland)	Education sector - Schools/Other
Biomathematics and Statistics Scotland	Academic/Research Institute
Centre for Excellence for Looked After Children in Scotland (CELCIS)	Academic/Research Institute
Centre of excellence for Sensor and Imaging Systems (CENSIS)	Academic/Research Institute
Scottish Informatics and Computer Science Alliance (SICSA)	Academic/Research Institute
Scottish Universities' Physics Alliance (SUPA)	Academic/Research Institute
Aberdeen Science Centre	Science engagement
Dundee Science Centre	Science engagement
Dynamic Earth	Science engagement
Edinburgh International Science Festival	Science engagement

Respondent	Respondent Type
Field Studies Council	Science engagement
Glasgow Science Centre	Science engagement
Highlands and Islands Science Festivals/ Inverness Science Festivals	Science engagement
Kilmarnock Engineering and Science Society	Science engagement
National Museums Scotland	Science engagement
Scottish Maritime Museum	Science engagement
Scottish Seabird Centre	Science engagement
theSKYLAB	Science engagement
Babcock Marine (Clyde) Limited	STEM industry
BAE Systems	STEM industry
CH2M	STEM industry
Hewlett Packard Enterprise	STEM industry
Jacobs UK Ltd	STEM industry
MacTaggart Scott	STEM industry
Microsoft	STEM industry
OPITO	STEM industry
Pfizer	STEM industry
Raytheon UK	STEM industry
Rudman Consulting	STEM industry
ScottishPower	STEM industry
Serco NorthLink Ferries	STEM industry
SSE	STEM industry
Building Engineering Services Association (BESA)	STEM industry professional & representative bodies
Construction Industry Training Board (Scotland)	STEM industry professional & representative bodies
Construction Scotland Innovation Centre (CSIC)	STEM industry professional & representative bodies
Engineering Construction Industry Training Board	STEM industry professional & representative bodies
Engineering Development Trust	STEM industry professional & representative bodies
Engineering Skills Leadership Group	STEM industry professional & representative bodies
Food and Drink Federation Scotland	STEM industry professional & representative bodies
Industrial Biotechnology Innovation Centre (IBioIC)	STEM industry professional & representative bodies
Institution of Civil Engineers Scotland	STEM industry professional & representative bodies
Institution of Mechanical Engineers	STEM industry professional & representative bodies
Science, Engineering and Manufacturing Technologies Alliance (Semta)	STEM industry professional & representative bodies
ScotlandIS	STEM industry professional & representative bodies
Scottish Aquaculture Innovation Centre (SAIC)	STEM industry professional & representative bodies
SELECT - The Electrical Contractors' Association of Scotland	STEM industry professional & representative bodies
The Digital Health and Care Institute	STEM industry professional & representative bodies
The Scottish Electrical Charitable Training Trust (SECTT)	STEM industry professional & representative bodies
UK Interactive Entertainment (Ukie)	STEM industry professional & representative bodies

Respondent	Respondent Type
Energy Skills Partnership	Other STEM education, professional & representative bodies
Learned Societies' Group on Scottish STEM Education	Other STEM education, professional & representative bodies
Royal Society of Biology	Other STEM education, professional & representative bodies
Royal Statistical Society	Other STEM education, professional & representative bodies
Science Connects (University of Glasgow)	Other STEM education, professional & representative bodies
Science, Technology, Engineering and Mathematics Education Committee (STEMEC)	Other STEM education, professional & representative bodies
Scottish Schools Education Research Centre (SSERC)	Other STEM education, professional & representative bodies
Scottish Science Advisory Council	Other STEM education, professional & representative bodies
STEM Learning Ltd	Other STEM education, professional & representative bodies
Technology Advisory Group (TAG)	Other STEM education, professional & representative bodies
British Academy	Other professional & representative bodies
Close the Gap	Other professional & representative bodies
Colleges Scotland	Other professional & representative bodies
COSLA	Other professional & representative bodies
Educational Institute of Scotland	Other professional & representative bodies
General Teaching Council Scotland	Other professional & representative bodies
NUS Scotland	Other professional & representative bodies
Royal Society	Other professional & representative bodies
School Leaders Scotland	Other professional & representative bodies
South East of Scotland Transport Partnership	Other professional & representative bodies
Voice	Other professional & representative bodies
YouthLink Scotland	Other professional & representative bodies
Aberdeen City Council	Local authorities and other public bodies
Argyll and Bute Council	Local authorities and other public bodies
Glasgow City Council	Local authorities and other public bodies
Highlands and Islands Enterprise	Local authorities and other public bodies
Ministry of Defence	Local authorities and other public bodies
North Ayrshire Council	Local authorities and other public bodies
South Lanarkshire Council	Local authorities and other public bodies
Transport Scotland	Local authorities and other public bodies
West Lothian Council	Local authorities and other public bodies
Comann nam Pàrant	Third sector/Non-profit organisations
Equality Challenge Unit	Third sector/Non-profit organisations
Equate Scotland	Third sector/Non-profit organisations
Families into STEM	Third sector/Non-profit organisations
Girl Geek Scotland (At Napier Red Triangle)	Third sector/Non-profit organisations
Let Toys Be Toys	Third sector/Non-profit organisations
National Parent Forum of Scotland	Third sector/Non-profit organisations
Nuffield Foundation	Third sector/Non-profit organisations
Primary Engineer	Third sector/Non-profit organisations

Respondent	Respondent Type
Prince's Trust Scotland	Third sector/Non-profit organisations
Scottish Council for Development and Industry	Third sector/Non-profit organisations
Scottish Out of School Care Network	Third sector/Non-profit organisations
Wellcome Trust	Third sector/Non-profit organisations
Zero Tolerance Charitable Trust	Third sector/Non-profit organisations
Zero Waste Scotland	Third sector/Non-profit organisations



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