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## Introduction

The future prosperity of the UK is, to a large extent, dependent on young people choosing STEM-related subjects (science, technology, engineering, maths). For young people, STEM opens doors to a rich diversity of opportunities, which can improve the quality of people's everyday lives and find solutions to global challenges, such as sustainable economic development.

Recent research highlights the shortfall in the number of people choosing to study STEM subjects, as well as the need to double the supply of skilled workers in STEM-related jobs in the next seven to ten years. **An important aspect is the issue of gender and ethnicity imbalance in the supply. (See Section 4 Equality and Diversity)** Both females and some ethnic minority groups are greatly under-represented (see Sections 4 Equality and Diversity) in relation to the overall cohort taking STEM subjects and also to the numbers entering STEM-related jobs.

*STEM skills are valued by employers across different sectors, with almost three quarters (72%) of firms employing STEM-skilled staff. In particular, STEM skills are vital to areas of future growth and employment including advanced manufacturing and low carbon industries. Yet 45% of employers are currently having difficulty recruiting STEM-skilled staff, with almost six in ten (59%) of firms expecting difficulty in the next three years.<sup>1</sup>*

To tackle the decline we need to engage the interest and enthusiasm of young people, and demonstrate the relevance of STEM knowledge and skills to everyday life. **It is also vital that careers practitioners help young people to understand the importance of STEM subject choice and their impact on progression opportunities.** The Careers Professions Task Force report recommended that initial training and CPD should include a focus on LMI, ICT and STEM as critical to delivering high quality guidance.<sup>2</sup>

We also need to promote excitement about the UK's world-class science base in sectors including pharmaceuticals, aerospace, telecommunications, mobile phone technology, oil and gas exploration, along with the increasing demand for scientists, engineers and technicians. The Science for Careers Report of the Science and Society Expert Group, March 2010, has highlighted that there is also a great deal of 'hidden' science and technology in use in the high street, including supermarkets (e.g. food and drink, packaging, logistics, IT, finance), fashion (including textile technology, materials, computer aided design, dyes), and the built environment (e.g. construction

engineering, materials sciences, environmental issues, energy). Tutors, teachers and advisers will be cautious about labour market messages proclaiming a growing demand. However, there is strong evidence of a future demand for STEM skills with an example being in the manufacturing sector.<sup>3</sup>

Employers value people with STEM qualifications and skills, not only for their specific knowledge and skills, but also for the transferrable skills of analysis, problem solving and creativity.

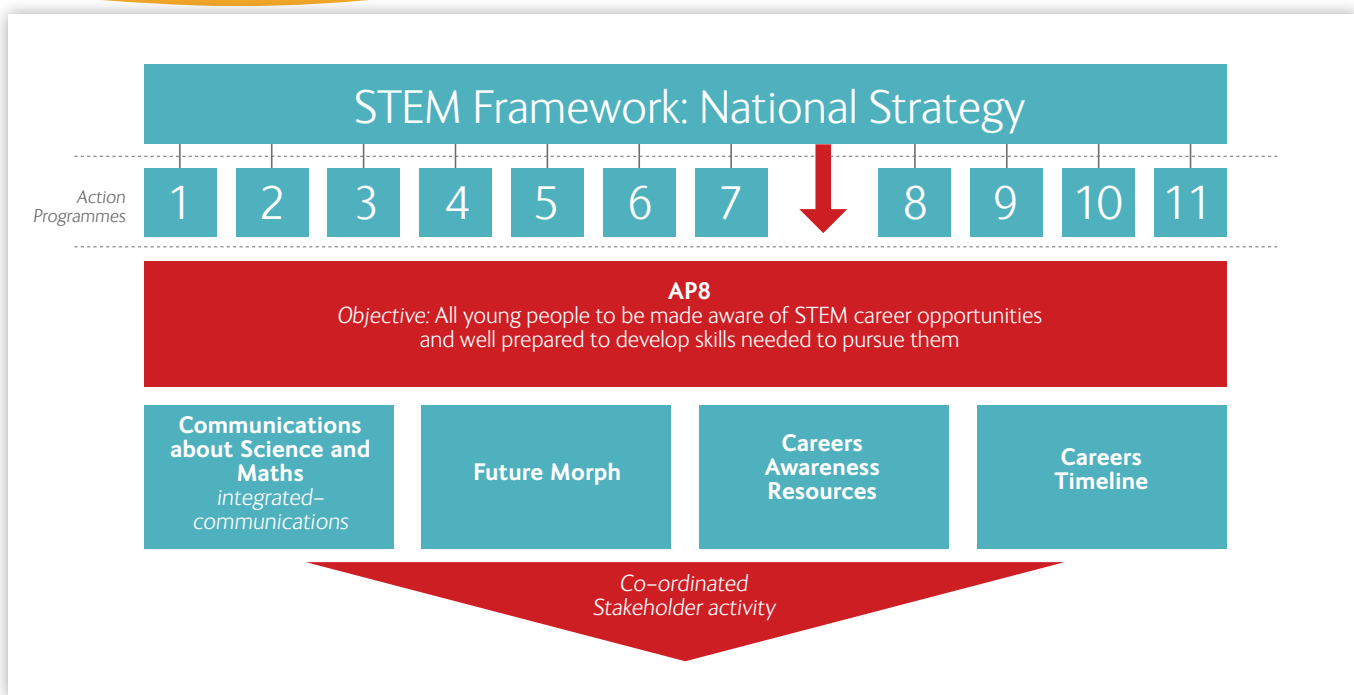
We are all living in a world struggling to deal with issues of **climate change and a rising population**, with associated demands on **water supply, food production and energy**. This challenging background means that **young people** can both **build strong futures** and **make a difference** by choosing STEM subjects and careers.

1. CBI/EDI Education and Skills Survey 2010

2. Towards a Strong Profession DfE 00550-2010

3. The EngineeringUK Report 2011 has identified that by 2017, 587,000 new workers will need to be recruited into the manufacturing sector.





**The eleven Action Programmes of the National Strategy are part of a ten year plan to improve take-up and achievement in science and maths. They aim to:-**

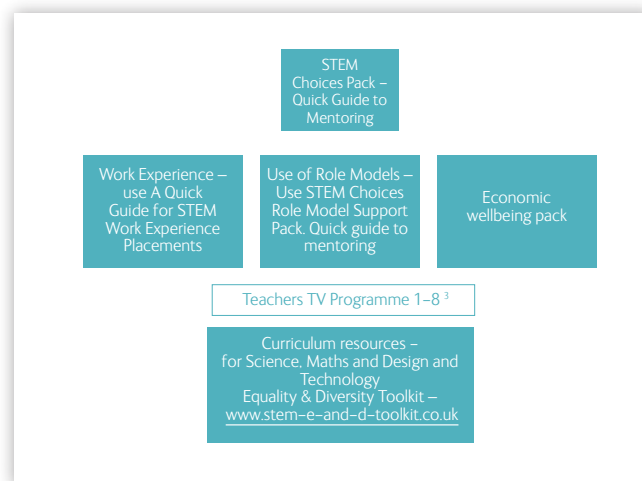
- Get the right people to become teachers and lecturers
- Encourage continuing professional development for teachers and engage teachers in technology and engineering
- Bring real-world context and applications of STEM into schools and colleges to enrich teaching
- Show young people the rich range of careers opportunities that STEM study opens up
- Get the STEM curriculum and infrastructure right including enhancing the quality of practical work

**Action programme 8, the Careers Awareness strand, has included:-**

- Communications with young people and parents to improve the take-up of science and maths subjects post-16<sup>1</sup>
- The Future Morph website for young people aged 11-18 to help engage them in studying science and maths by demonstrating the huge range of career opportunities available by pursuing these subjects
- A range of careers awareness resources for schools, teachers and careers education and IAG professionals to complement the public facing elements
- A Careers Awareness Timeline pilot designed to establish a more coherent structure for young people to learn about careers relating to science and maths. The project has been spearheaded by Kate Bellingham, the National STEM Careers Coordinator.

1. Educating the next generation of scientists – DfE – November 2010 – reported that 44 per cent of students had seen the adverts and the proportions of students likely to take Maths A level increased from 52 to 62 per cent and had changed the opinion of 41 per cent of parents about their child taking science or maths at A level.

The Careers Awareness project was run by the Centre for Science Education at Sheffield Hallam University, in partnership with Babcock, a leading provider of careers resources and consultancy. The project has produced a range of targeted online and printed resources to help teachers, tutors, employers and other stakeholders to support STEM careers awareness (see figure below). The design of the products recognises that careers information and guidance can help encourage young people to want to pursue science and maths and that “career learning and development is constructed through activity and in interactions with a variety of people (including career professionals, employers, teachers, parents and peers).”<sup>2</sup>



The resources can be downloaded from [www.futuremorph.org](http://www.futuremorph.org), the online portal for STEM careers. See also the STEM Careers Awareness collection at [www.nationalstemcentre.org.uk](http://www.nationalstemcentre.org.uk).

2. An Introduction to Career Learning and Development 11-19 (2011)

3. The Teachers TV programmes illustrate good practice as subject teachers and careers staff bridge the gap between the classroom and the workplace. Search for STEM Subject Choice & Careers to access the eight programmes.

The secondary curriculum itself provides a platform for using real-life applications to enhance teaching, engage the interest of young people and encourage initial career exploration. Interest and enjoyment of subjects, alongside whether young people consider themselves good at the subject are key factors in how young people form their career and subject identities. Embedding STEM careers into the curriculum is one of the routes open to raise awareness of students, and is strengthened by a partnership approach with career professionals. *“It is important to ensure that career routes and qualifications form an intrinsic part of all STEM courses ... this will require a partnership approach at the level of curriculum design from both careers professionals and teachers.”*<sup>1</sup>

**Maths** – important for all members of a modern society ... for its use in the workplace, business and finance ... tools for understanding economics ... essential for participation in the knowledge economy

- applications and implications of maths
- work on problems and in contexts beyond the school (e.g. financial).

**Science** – discover how scientific ideas contribute to technological change – affecting industry, business ...

- applications and implications of science
- experience science in the workplace, where possible.

**Design and technology** – skills and understanding of economic, industrial and environmental issues...evaluate present and past D&T, and its uses and effects

**ICT** – understanding to apply skills purposefully in learning, everyday life and employment...economic implications of its use.

Seeing the career possibilities of STEM subjects can be a positive motivator for students. The ‘STEM Careers Awareness Timeline’ strand of Action Programme 8 conducted in partnership with CEI (Centre for Education and Industry) at the University of Warwick, iCeGS (International Centre for Guidance Studies) at the University of Derby, and Isinglass Consultancy, surveyed 4073 Year 7 and Year 9 students to assess their current interest in STEM subjects and willingness to engage in STEM careers. Some of the key findings include:-

### Subject popularity and importance

- Maths and science were considered to be important subjects since they are needed to secure a good job. The percentage of young people who consider a career related to a STEM subject is comparatively high (with 59% contemplating future work linked with technology, 52% in science and 50% in mathematics; 38% would consider a career related to engineering).
- Boys were significantly more likely to choose engineering, ICT, maths and science in their top 3 subjects than girls.
- Higher socio economic status was associated with students being significantly more likely to choose science and design and technology in their top 3 subjects.
- Lower socio economic status was associated with students being

significantly more likely to choose engineering and ICT in their top 3 subjects.

- Male students were significantly more likely to agree or strongly agree that engineering is important for adult life (75%) and to get a job (58%) than girls (58% and 37% respectively).

### Considering a STEM career

- Students from the lower socio economic status schools were significantly more likely to consider an engineering related career than those from the higher socio economic status schools.
- The percentage of students considering careers related to engineering were generally lower than careers related to other STEM subjects, which **supports earlier conclusions that students perhaps lack understanding of engineering compared to other STEM subjects.**

The choices that young people make regarding their option choices and eventual career pathways are influenced by a variety of factors based on their personal histories and experiences, self-awareness and belief, and school-based support. By the time they reach Year 11 young people have often either consciously or instinctively introduced physical, emotional or cultural “boundaries” within which they will shape their choices. The main difference the survey found between reported attitudes of Year 7 and Year 9 students was a move away from science study during Key Stage 3 – particularly for girls, and an increasing awareness of sources of career related information and advice. The three waves of research completed by Babcock on behalf of Sheffield Hallam demonstrate the impact of planned interventions in increasing students’ interest in STEM careers and on the attitudes of staff (an increase from 45% to 64% of students agreeing that STEM careers can be enjoyable between waves 1 and 2 and an increase in STEM themed problem solving days from 27% to 54%). There is a clear challenge to improve the quality of careers education, information and guidance overall with a wealth of evidence available now about what works.

There is also overall agreement that the messages we want to share with young people about STEM courses and careers are:-

- STEM qualifications lead to a wide range of opportunities at different levels and are valuable for non-STEM jobs. They keep options open.
- STEM qualifications can help to address key global challenges such as climate change.
- STEM qualifications are valued by employers – 40% of businesses prefer STEM degrees when recruiting graduates.
- STEM courses and careers are open to all and can help raise aspirations.
- STEM helps develop enterprise and employability skills – analytical capabilities, problem solving, creativity.
- Many STEM jobs need creativity and design skills in combination with mathematical and scientific abilities
- Good salaries are available and locations for work vary, often not a desk or a laboratory

1. STEM Careers Review November 2010.

## What you can do and how the pack can help

There is a range of ways in which teachers, tutors and advisers can make a real difference to STEM careers awareness. See the key points outlined below and how the resource pack can support these tasks. Also see Section 9 for a signpost to other materials. You could also complete the development plan at the end of this section to identify priorities for your school/college across eight related strands of engagement with STEM Careers Awareness.

### What you can do

- Review your own continuing professional development needs in relation to STEM careers awareness. Young people value careers practitioners who have expert knowledge to enable them to access opportunities that are in their interest.
- Check your own knowledge and understanding of learning routes and progression possibilities for young people in STEM-related subjects. Ensure you are aware of a wide range of pathways for students of all abilities.
- Establish a shared understanding of the starting points and challenges in your area in relation to STEM take-up. Share general information about the perception of STEM subjects.
- Collaborate with STEM departments in your school/college to raise the visibility of STEM subjects and careers. Provide subject and careers information and resources for young people and their parents and carers, e.g. posters, displays in each department
- Build your knowledge of local agencies and initiatives that can support STEM-related enrichment and enhancement activities in your school/college. Contribute to thematic learning projects or suspended timetable activities
- Motivate and engage young people by involving them in activities where they need to use their STEM knowledge, understanding and skills to face future challenges e.g. food security, water shortage, energy supply
- Challenge stereotypes. Careers practitioners can help young people extend their 'horizons for action'. Often young women and black and minority ethnic students are under-represented in STEM courses and careers and may be held back by poor information and lack of positive role models.

### How the pack can help

all sections downloadable via  
[www.futuremorph.org/careers\\_staff](http://www.futuremorph.org/careers_staff)

See **Section 2:** Current & Future Trends  
See **Section 5:** Where's the Money?  
See signposts to Industry Focus Reports in Section 7

See **Section 3:** Learning Routes and Pathways

See **Section 2:** Current & Future Trends  
See **Section 4:** Equality and Diversity.  
See **Section 6:** STEM Careers Starters and Plenaries

See **Section 8:** Organising STEM events  
See **Section 9:** Websites and Sources of Information













See **Section 8:** Organising STEM Events  
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See also STEM Directories Online [www.stemnet.org.uk](http://www.stemnet.org.uk)





















See **Section 6:** STEM Careers Starters and Plenaries  
See signpost to Industry Focus report **Section 7**  
See **Section 8:** Organising STEM events

See **Section 4:** Equality and Diversity  
Also see the Equality and Diversity Toolkit  
[www.stem-e-and-d-toolkit.co.uk](http://www.stem-e-and-d-toolkit.co.uk)

## How to use the tool:

- identify where you are on each of the aspects of school/college practice (A–H)
- identify the changes needed to make the transition from your current level to the next on each of the eight aspects
- identify the mechanisms or interventions to help you achieve change
- identify existing resources and sources of support for making the transition
- identify any gaps in the help available and how they can be plugged.
- identify senior staff and governors to oversee and facilitate developments

	Level 1	Level 2	Level 3	Level 4
A. Teaching and Learning	<p>No explicit or planned reference to STEM contexts and careers in curriculum planning. Individual teachers might make occasional reference to STEM careers if opportunities arise.</p> 	<p>Some STEM teachers make use of work related contexts to achieve greater student engagement in STEM subjects.</p> 	<p>Widespread use of work related contexts to support curriculum planning and delivery by teachers across the STEM subjects.</p> 	<p>Whole school/college approach to use of work related contexts to support curriculum planning and delivery across all the STEM subjects.</p> 
B. Student personal skills and capabilities	<p>No verbal awareness of their own personal skills or capabilities. No planned acknowledgement of personal skills or capabilities within the curriculum. Teachers rarely make reference to personal skills.</p> 	<p>Reasonable awareness of personal skills &amp; capabilities development and is able to give examples. Teachers occasionally use associate language in ad-hoc way. Reference to skills is driven by individual teacher enthusiasm rather than whole school/college action.</p> 	<p>Good awareness of personal skills and capabilities and can give examples and identify what made them worthwhile. Explicit progressive and inclusive provision is given to personal skills &amp; capabilities in subject lessons. Whole school/college and curriculum activities by most staff.</p> 	<p>Strong awareness of personal skills and capabilities and can give examples, identify worthy features and describe why they are useful. They work with other students to peer assess and coach others, and actively seek out opportunities to develop further. They experience personal skills &amp; capabilities embedded into school/college and lesson activities by most staff; parents know about them.</p> 
C. Teacher Awareness of STEM careers	<p>Low level of subject teacher awareness of STEM career pathways and use of STEM subjects in the workplace.</p> 	<p>Some STEM teachers are aware of career pathways and use of STEM subjects in the workplace. Use is made of Future Morph and maths careers.</p> 	<p>Widespread knowledge and use of STEM subjects in the work place and career pathways. Teachers confident to answer front line enquiries from students and to help them make effective use of the wide range of web and hard copy STEM careers information.</p> 	<p>Whole school/college approach to updating teachers on STEM applications and career pathways. Positive use of this knowledge to enthuse and engage students. Direct links to Future Morph, and maths careers. Teachers actively support students' career exploration and refer them for further guidance.</p> 

<p><b>D. Enhancement and enrichment</b></p>	<p>Rare use made of enhancement and enrichment activities. Individual STEM teachers might make use of occasional STEM visitors from industry. </p>	<p>Some use made of STEM enhancement and enrichment activities with some students, though this tends to be only with those already committed to STEM subjects. </p>	<p>Good use of STEM enhancement and enrichment activities with substantial numbers of students. High level of awareness amongst staff of the opportunities and benefits of this approach and of STEM Directories </p>	<p>Whole school/college approach to STEM enhancement and enrichment. Progressive programme for Key Stages 3, 4 and post-16. Support for students to reflect on learning and the connections to and implications for career choice. </p>
<p><b>E. Equality and diversity</b></p>	<p>No explicit plan to tackle limited and stereotypical views of STEM courses and careers. </p>	<p>Efforts made to tackle student and parents' stereotypical views of STEM courses and careers by some teachers through role models and curriculum materials. Some recognition of equality duties. </p>	<p>Good recognition of equality duties. Active use of role models and mentors to promote equality in STEM subjects and careers. Targets set to achieve representative participants in STEM enrichment activities. Strategy in place to deliver an inclusive STEM curriculum. </p>	<p>Creative, whole school/college approach to equality duties that engage all students in successful experiences of, and progression, in STEM courses and ensure that all students are able to fully achieve their potential. Differentiated activities to engage under-represented student groups in STEM courses and activities. </p>
<p><b>F. Communication about STEM careers</b></p>	<p>No explicit efforts made to raise awareness of STEM careers by teachers or personal advisers. </p>	<p>Individual teachers try to raise awareness of STEM careers in class and with individual students in response to interest. Personal advisers run group work and provide information, advice and guidance on STEM opportunities in response to requests. </p>	<p>There are comprehensive efforts by STEM teachers through displays, visiting speakers, discussions, and information for individual students to raise awareness of STEM courses and careers. Personal advisers make positive efforts to broaden students' knowledge of STEM opportunities through group sessions, presentations at events, etc. </p>	<p>There is a whole school/college strategy for communication about STEM choice and careers with students and parents. This is evident in the careers library, schools/college intranet and displays, as well as newsletters and events. There is a widespread commitment to the social and economic benefits of STEM careers. Personal advisers contribute to this strategy </p>
<p><b>G. Leadership and management</b></p>	<p>No explicit lead on STEM choice and careers. </p>	<p>STEM faculty heads are aware of potential and make efforts to encourage students to progress in STEM subjects. </p>	<p>STEM faculty heads have started to define a strategy for encouraging students to explore STEM careers and develop interest in further STEM study through curriculum development and enrichment and enhancement activities. Some monitoring of student participation and achievement in STEM subjects to monitor effect. </p>	<p>Whole school/college STEM engagement and careers policy in place in partnership with other key agencies. Monitoring of effectiveness is undertaken by studying participation and achievement in STEM subjects and career choice. </p>
<p><b>H. Partnerships</b></p>	<p>No explicit links are in place with partners such as local universities, the all-age careers service and STEM enrichment providers to support STEM subject choice and careers. </p>	<p>Some individual teachers have links with partners to enhance delivery. </p>	<p>STEM Faculties have good links with key partners from higher education, Aimhigher and industry to enhance student learning. These are celebrated within the school/college and wider community. </p>	<p>The STEM careers policy is developed, delivered, reviewed and celebrated in close collaboration with key partners including Aimhigher, local universities and industry. </p>