1 Introduction

The importance of STEM and the contribution of careers education and IAG

The future prosperity of the UK is, to a large extent, dependent on young people choosing STEM-related subjects. Science, technology, engineering and maths (STEM) subjects are vital to the country's economic and social development. The role of STEM skills is to help 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.

By 2014, it is expected that the UK will need to fill around three–quarters of a million extra jobs requiring highly numerate, analytical people with STEM skills. Yet currently, six out of ten (59%) firms employing STEM–skilled staff say they are having difficulty recruiting. The low take–up of STEM subjects at university is a large part of the problem and there has been a 15% fall in engineering and technology graduates (23,300 to 19,700) over the past decade.[1]

Young people build up their knowledge and understanding of science and maths on a gradual basis. Once dropped, maths and physical science subjects are much harder to return to later. Young people can cut themselves off from a whole range of careers by not continuing their STEM education.

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.

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.

As we face global recession, tutors, teachers and advisers will be cautious about promoting messages about growing demand, only for young people's hopes to be blighted when companies shed staff. There is strong evidence of continuing investment[2] in current and future STEM skills suggesting that the demand for new entrants will hold up. Future updates to this resource will analyse this trend in more detail.

1.CBI/Edexcel Education and Skills Survey 2008
2.The Government and Cogent Sector Skills Council is making £50m available for employers in the national skills council's vital science–using sector. The ring–fenced fund is aimed at both the training of new entrants and apprentices and qualifying existing workers in the chemicals, polymers and pharmaceuticals sector. The offer is directed at the specific skills needs of the sector and a range of technical qualifications which embed skills for competitiveness within companies.

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.

Relevant National Initiatives

An unprecedented range of new and continuing initiatives by the Government, professional bodies, education–business partnerships and employers are seeking to transform the teaching of STEM subjects, promote choice of STEM courses and careers and improve public understanding of science.

Jim Knight, Minister of State for Schools and Learners, explains the Department for Children, Schools and Families' (DCSF) campaign to promote STEM subjects and careers:

The UK is standing at a crossroads. We're a world leader in research and development, in areas including clean technology, biotechnology and pharmaceuticals. The future prosperity of this country is dependent on a ready supply of skilled scientists to ensure we capitalise fully on the strength of our research and development heritage...at the moment, we simply don't have enough young people choosing science–related subjects.

Central to the campaign is the need to challenge young people's perceptions by showing them that studying science and maths subjects can set them on a path to a challenging and rewarding career. The growing demand for new technology to help fight climate change is just one reason behind the many different opportunities for an exciting and rewarding career. The UK is in prime position to capitalise on its research and development credentials – the challenge for us now is to help get young people excited about where science and maths could take them – and to provide them with the resources and support to fulfil their potential once on this path.

The introduction of the new Secondary Curriculum from September 2008 provides valuable support to exploring career learning and STEM. A programme of study for economic wellbeing and financial capability (as part of personal, social, health and economic (PSHE) education) encourages schools to help students to:

- expand their horizons for action by challenging stereotyping, discrimination and other cultural and social barriers to choice
- aim high
- build a positive and realistic view of needs and capabilities so that they can make effective learning plans, decisions and transitions
- be aware of changing career opportunities and develop the knowledge and skills to make informed decisions about learning programmes.

Guidance from the Qualifications and Curriculum Authority on PSHE curriculum provision asks schools to offer:

- specific lessons as part of PSHE
- explicit, planned content in other curriculum subjects
- whole school and extended timetable activities
- specific projects and experiences.

For the first time there is also explicit reference to the real–life application of each of the subjects, with real scope for a strong partnership between STEM subject teachers and those responsible for PSHE education and wider personal and career development. The importance statements for key STEM subjects highlights their work–related elements, for example:

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.

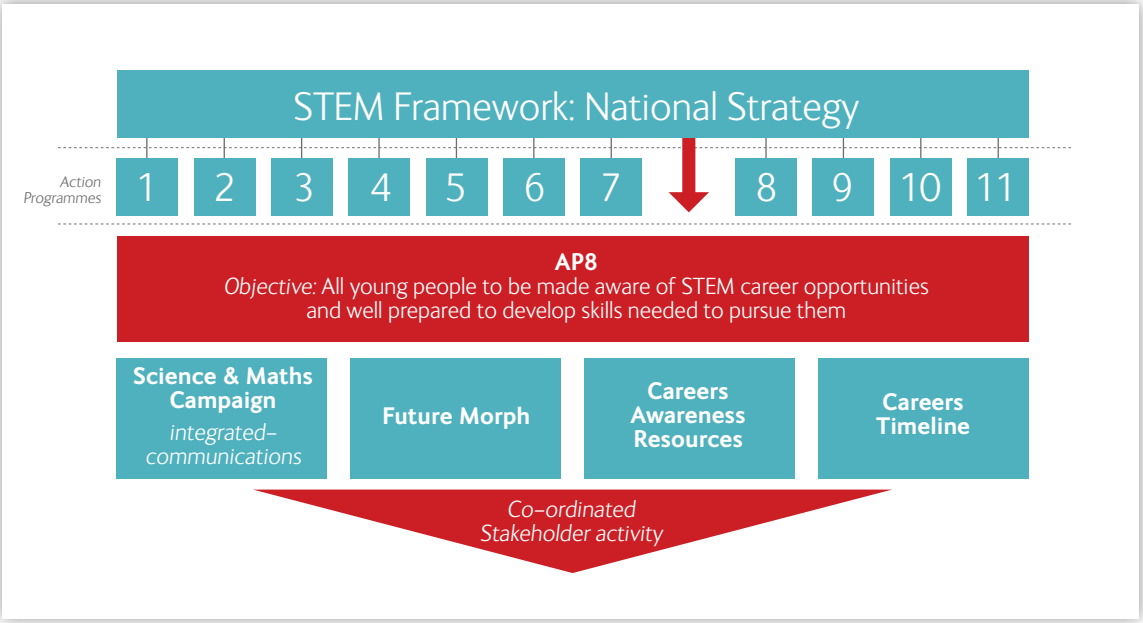
The Department for Innovation, Universities and Skills (DIUS) is actively involved in addressing skills shortages, science in society initiatives and the role and contribution of higher education to the STEM agenda. DIUS recently announced **The Science So What? So Everything** campaign which includes video clips, case studies and information to improve the public perception of science. (see http://sciencesowhat.direct.gov.uk)

The Government is supporting a network of National Skills Academies delivering the skills required by each sector of the economy. Skills Academies in the STEM arena include Construction, Food and Drink Manufacturing, Nuclear, Process Industries, Materials Production and Supply, Power and Information Technology.

The Department for Business, Enterprise & Regulatory Reform (BERR) has also recently published Manufacturing: New challenges, New Opportunities which announced the launch of a Manufacturing the Future campaign to change public perception of manufacturing and to ensure young people are aware of the exciting career opportunities available.

Action Programme Eight – Raising Awareness of STEM Careers

The Careers Awareness Programme is one of eleven Action Programmes that make up the National STEM agenda under the Director John Holman (See The STEM Framework, July 2008 http://www.stemdirectories.org.uk/docs/STEM_Framework.pdf)



The programme, co-ordinated by the Centre for Science Education at Sheffield Hallam University in partnership with VT Enterprise, seeks to tackle a number of key issues:

- Arrest the declining numbers of young people studying STEM subjects
- Improve awareness of STEM careers
- Tackle the skills gap
- Assure a more representative take-up of STEM subjects and careers in terms of age, gender, ethnicity
- Provide continuing professional development for STEM staff
- Promote activities and careers advice that bring real world contexts and applications of STEM into the classroom
- Ensure that the STEM education support infrastructure is better co-ordinated.

Kate Bellingham
The National STEM Careers Co–ordinator

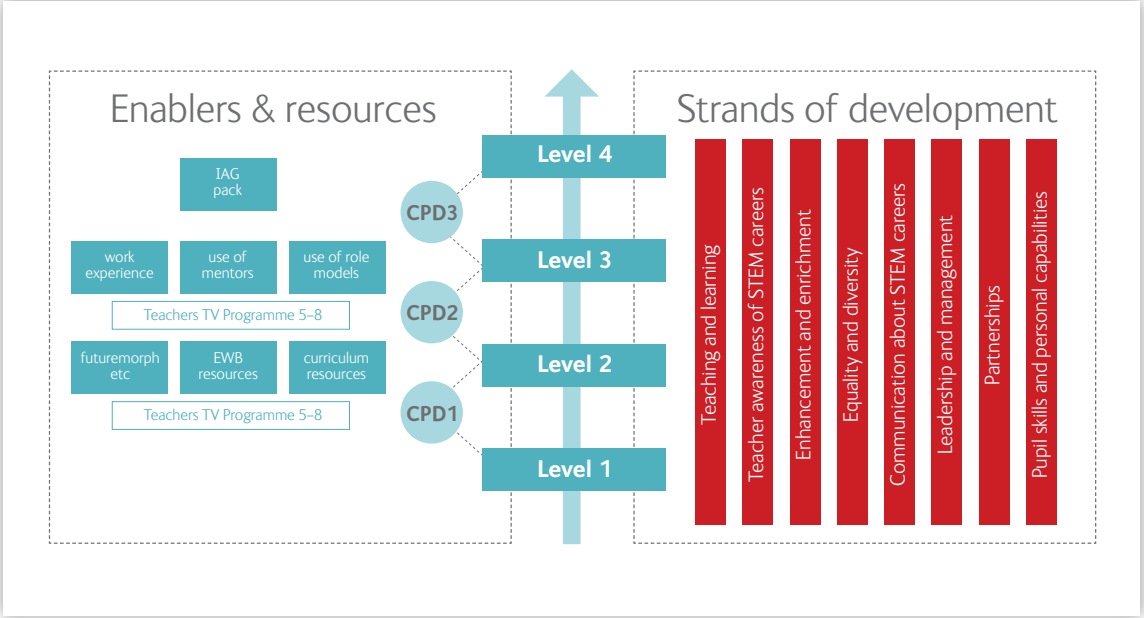
Kate Bellingham as National STEM Careers Co–ordinator is at the centre of the programme.

I'm delighted to have taken on the role of National STEM Careers Co–ordinator. I've been involved in the promotion of STEM for many years, and I know we currently have a unique window of opportunity to make a real difference to our young people in the area of STEM careers. The changes in secondary curriculum, new quality standards in information, advice and guidance, improved structure in enhancement and enrichment activities and support through the STEM Framework all provide an ideal foundation for significant change. As well as the co–ordinating role, providing a conduit for ideas and collaboration, I would like to be a 'champion' for STEM careers. Expect to see and hear me out and about promoting and supporting the campaign.

The four key strands of the programme are:

- a communications campaign to engage young people, their parents, the workforce and relevant stakeholders to improve the take–up of science and maths subjects post–16
- the Futuremorph 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
- 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 chart below outlines the main strands of development for the careers awareness resources. The enablers and resources are products that will help to deliver the strands of development through the programme's continuing professional development activities.



This pack for careers education (CE) and information, advice and guidance (IAG) practitioners is central to engaging tutors, subject teachers, personal and careers advisers in the business of STEM careers awareness. It will be updated and supplemented throughout the three years of the project to help boost the confidence and readiness of front–line staff to engage with young people and their parents about STEM choices, and to give well–informed and up–to–date information on the current demand and likely future trends in relation to STEM opportunities.

The pack seeks to help CE/IAG practitioners to *broaden young people's perspectives* and to *challenge stereotyped images of sectors and occupations.* It demonstrates the relevance of STEM to everyday life, and captures the excitement and *creativity involved in developments such as:*

- mobile phone technology
- satellite navigation systems
- digital technology
- nanotechnology
- fuel cell technology
- space technology
- bioinformatics

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.

There is also a wide range of other initiatives and developments practitioners can draw on including other strands of the STEM Careers Awareness Action Programme such as role models and equality and diversity resources. Please see **Section 9**: Where To Find More Information for a signpost to other materials.

What you can do	How the pack can help
• Review your own continuing professional development needs in relation to STEM careers awareness. Credibility is a very important characteristic in the eyes of young people. They will seek and accept CE/IAG help only from those who have it! Young people value CE/IAG practitioners who have knowledge, especially insider knowledge, power and influence to enable them to access opportunities that are in their interest. The IAG standards state that IAG must be 'impartial' but there is room for positive partiality to act in the best interests of the young person.	See **Section 2:** Current and Future Trends. See **Section 5:** Where's the Money? See the Industry Focus reports and case studies in **Section 7.** These will be progressively updated through the life of the project.
• Check your own knowledge and understanding of learning routes and progression possibilities for young people in STEM–related subjects. New and expanded provision, especially Diplomas and Apprenticeships, is changing the face of local opportunities. Familiarise yourself with the resources that young people themselves are using such as the online local area prospectus. Ensure you are aware of a wide range of pathways for pupils of all abilities not just for high flyers.	See **Section 3**: Learning Routes and Pathways.

What you can do	How the pack can help
• Establish a shared understanding of the starting points and challenges in your school/learning network in relation to STEM take-up. Share general information about the perception of STEM subjects, e.g. the quality of teaching, motivation and interest of learners.	See **Section 2:** Current and Future Trends.
• Collaborate with STEM departments in your school/learning network/partnership to raise the visibility of STEM subjects and careers and to communicate that, where young people are taking STEM subjects, they are seen to be successful and enjoying themselves. Provide subject and careers information and resources for young people and their parents and carers, e.g. posters, displays in each department.	See **Section 9**: Where to Find More Information.
• Build up your knowledge of local agencies and initiatives that can support STEM-related enrichment and enhancement activities in your school and ensure that these contribute to the career planning of individual young people.	See **Section 8:** Organising STEM Events and **Section 9:** Where To Find More Information. Updates to the pack will share information from the the STEM Careers Awareness Timeline Pilot on good practice in the process of learning about STEM careers. Collaboration between careers staff and STEM staff is a key element in this work. To access the self-review and development framework being used in the STEM Careers Awareness Timeline Pilot contact info@careersinstem.co.uk Contact your regional STEM Partnership and search on 'Schemes, Activities and Projects' for examples of careers events http://www.stemcentres.org.uk/home See also STEM Directories (Science, Engineering and Technology, Mathematics) http://www.stemdirectories.org.uk/
• Motivate and engage young people by involving them in activities where they need to use their STEM knowledge, understanding and skills to discuss and make decisions about demographic, social, economic, environmental, medical and security challenges facing us, e.g. food, water, energy.	See Industry Focus reports and case studies. See also **Section 9**: Where To Find More Information for links to futuremorph. See **Section 6**: Making presentations for group work ideas.

What you can do	How the pack can help
• Challenge stereotypes. CE/IAG 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.	See **Section 4**: Equality and Diversity. The first edition of the pack focuses on women. Subsequent updates will address inclusion issues in relation to other groups.
• Contribute to thematic learning projects, e.g. collaborate with citizenship teachers to explain how science is regulated to protect the needs and interests of citizens.	See **Section 8**: Organising STEM Events.