

The STEM Framework

– a guide for schools and colleges

Science
Technology
Engineering
& Mathematics



What is this publication?



The term “STEM” groups together the subjects of Science, Technology, Engineering and Mathematics – all closely interlinked in solving many of the challenges facing modern society.

This publication, taken together with its sister publication *The STEM Framework*, is to inform and inspire schools and colleges about the work being done locally, regionally and nationally to increase the uptake and success of learners in STEM subjects.

In recent years a programme has been developing to better coordinate the resources committed to STEM education by the Department for Children, Schools and Families; the Department for Innovation, Universities and Skills; learned societies; industry and business; and other stakeholders.



This publication outlines the opportunities that are opening up for learners, teachers, schools and colleges.

Who is it for?

Read with *The STEM Framework*, this publication is aimed at educators at **all** levels in schools and colleges in the UK (including primary, secondary, special schools, FE colleges – and from the state and independent sectors):

- Headteachers, Principals and Senior Leaders responsible for the development of standards and curriculum; and for cross-curricular developments
- Specific staff such as Specialist College Directors; CPD coordinators and staff development managers; careers staff
- Subject leaders in science, technology, engineering and mathematics, and related subjects
- Teachers of science, technology, engineering and mathematics, and related subjects



Why should you read it?

Read this document to capitalise on the wide range of initiatives being offered by Government, industry and other stakeholders in order to:

- Raise standards in STEM subjects, develop a wider STEM curriculum better suited to your learners, and engage them using relevant, exciting ‘real world’ contexts
- Recruit, retain and further develop staff who teach STEM subjects
- Show learners the careers open to them through success in STEM subjects
- Take advantage of the resources offered by industry, Government and learned societies to support STEM education in your school or college
- Raise the profile of STEM subjects within your school or college – with learners, parents, teachers and leadership
- Use a focus on STEM to channel overall school and college improvement, and strengthen partnerships with other schools and colleges.

Further exploration of what this means for your school or college, and what you can do next, is included.

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Supporting the delivery of the STEM Cohesion Programme on behalf of the Department for Children, Schools and Families

This publication, *The STEM Framework – a guide for schools and colleges*, is intended to be read alongside its sister publication *The STEM Framework*

How did we get here?

The background to the STEM Programme

First and foremost, STEM subjects are important to the education and life-chances of every young person in the country. The profile of STEM subjects also affects the future prosperity of the country itself.

Pages 1 to 3 of the accompanying document *The STEM Framework* outline the background to the development of the STEM Programme and a Framework for a more coherent approach for those investing public, private and charitable funds in STEM education.

Linking STEM education to the outside world

At the school and college level, STEM is typically treated as separate subjects (science, mathematics, design & technology, engineering etc.). In the outside world, however, real-life scientific and technological opportunities and challenges simply do not slot neatly into these categories.

While all schools and colleges are restricted by timetables and staffing to varying degrees, many grasp opportunities such as:

- Building a stimulating curriculum where the links across all STEM subjects are explicit to teachers and learners alike – and perhaps doing so with feeder and other partner schools and colleges
- Drawing on outside organisations to engage learners – by using ‘real world’, cross-curricular STEM contexts and challenges
- Working together with scientists, technologists, engineers and mathematicians from the world of work to give learners an exciting yet realistic picture of a future which motivates them to choose these subjects
- Highlighting the wide range of rewarding careers available to those who choose STEM subjects in school or college.

These schools and colleges are working to achieve: increased motivation and engagement of learners and teachers; rising standards; a higher profile for the school or college amongst learners, parents and employers; and interest from other teachers keen to develop their careers in a dynamic STEM-focused institution.

The STEM Programme is intended to act as a catalyst so that all schools and colleges can be helped to construct a curriculum relevant to local needs and circumstances, and which supports and inspires individual learners. This can be achieved through increasing the diversity of skills and confidence of teachers – and by making relevant ‘real world’ contexts more accessible to teachers and learners as part of the mainstream curriculum.¹

¹ When reporting on STEM subjects in schools and colleges, Ofsted reports refer to (amongst other factors) the importance of vocational and academic curriculum pathways; the engagement of learners; the relevance of subjects to learners, and the application of knowledge and skills; connections between subjects; the need for teachers of STEM subjects to keep up-to-date through CPD, contact with industry etc. For example:

- Success in science (2008)
- Education for a technologically advanced nation (2008)
- Identifying good practice: a survey of college provision in engineering and manufacturing technologies (2008)
- Evaluating mathematics provision for 14–19-year-olds (2006)

www.ofsted.gov.uk



What does this mean for my school or college, and my students?

It is young people who are the ultimate beneficiaries of the work being done – but the skills and energy of the staff and leaders in schools and colleges are critical.

A focus on STEM education has clear long-term benefits to both individuals and the country, but there are long and short-term benefits to learners, teachers and their schools and colleges, such as improvements in:

- Standards in mathematics and science at KS2 to KS4, and on into post-16 education in all STEM subjects
- Motivation, engagement, success and an increase in progression in the full range of STEM subjects
- Teaching skills and motivation of teachers of STEM subjects
- Provision for:
 - 14-19, and the new diplomas
 - cross-curricular elements for the new secondary curriculum
 - many aspects of Every Child Matters
 - Work-Related Learning – links with employers and aspects of vocational provision
 - many elements of “How Science Works” at KS3 and GCSE
- Specialist College designation – whether STEM-related or other specialisms – and the positive effect it can have on partnerships with other schools
- Inspection outcomes, and self evaluation and review.

The Action Programmes outlined on pages 4 to 11 of *The STEM Framework* each have a Lead Organisation to help coordinate new and existing initiatives in STEM as they affect schools and colleges.



The STEM Framework has identified actions to...	...so that schools and colleges will see, for example:
<ul style="list-style-type: none"> • attract and train the right teachers and lecturers of STEM subjects in the first place 	<ul style="list-style-type: none"> > an improvement in the calibre and experience of new teachers joining the profession
<ul style="list-style-type: none"> • provide the right CPD for teachers of STEM subjects 	<ul style="list-style-type: none"> > more opportunities for teachers to take up relevant, high-quality CPD > less duplication between the STEM CPD on offer across the country through different CPD providers
<ul style="list-style-type: none"> • provide the right activities and careers advice that bring real-world context and applications of STEM into the classroom ('enhancement and enrichment') 	<ul style="list-style-type: none"> > increased availability of high quality, authentic and inspirational resources and activities that embed real-world context in the curriculum > resources and ideas to help teachers advise learners better on the wider range of career options open by continuing to study STEM subjects > more opportunities for learners to meet working scientists and technologists to help them both learn in a real-world setting and better inform their life-choices
<ul style="list-style-type: none"> • get the STEM curriculum in the classroom right 	<ul style="list-style-type: none"> > further development of opportunities at all key stages (including the 14-19 curriculum) to increase flexibility and allow teachers, schools and colleges to use real-world and cross-curricular contexts while remaining responsive to local industry and employer needs
<ul style="list-style-type: none"> • get the STEM education support infrastructure right. 	<ul style="list-style-type: none"> > enhanced coordination of STEM-related support for schools and colleges at local, regional and national levels > more consistent evaluation of the effectiveness of support, CPD, resources and activities to help you make more informed choices from the range of available opportunities

What can you do next?

Review your own school's or college's approach to STEM – for example:

How often, and with what effect, do **learners** at all ages...?

- work on challenges from the world of work and real-life, and see the skills they have developed in STEM subjects transferring right across the wider curriculum
- take on courses in STEM subjects from a range that meets individual needs
- meet people with a STEM education and qualifications, other than their teachers
- get realistic advice on the many careers that STEM qualifications lead to, other than just "becoming a scientist/engineer/mathematician"
- see their teachers of STEM subjects collaborate.

How often, and with what effect, do **teachers** of STEM subjects...?

- work with other teachers from outside their subject areas, or share good practice with teachers from other schools and colleges
- work with organisations from the STEM-related workplace, or those who can help with activities and opportunities to enrich the curriculum
- update their knowledge, skills and pedagogy in STEM subjects – many of which will have continued to change rapidly since they qualified.

How often, and with what effect, does the **school or college**...?

- exploit the contribution that a focus on STEM can make to the development of leadership skills, self-evaluation, review and improvement, Every Child Matters, Work-Related Learning, Specialist School designation etc.



Get in touch with some of the many organisations who can support and inspire, for example:

- > **Neighbouring schools and colleges** – those from the same phase, as well as the others through which your learners progress
- > **Local support and CPD** – including:
 - for schools, your Local Authority and National Strategy consultants, advisers and resources etc.
 - for colleges, the Learning and Skills Improvement Service, the Institute for Learning etc. while STEM-specific support is available through the Post-16 STEM Programme within the Quality Improvement Agency's Teaching and Learning Programme
- > **Using real-world contexts to enhance and enrich the curriculum**
 - for your nearest organisation holding a STEMPOINT contract; for Science and Engineering Ambassadors; and for After School Science and Engineering Clubs – contact STEMNET www.stemnet.org.uk
 - a printed directory of schemes and activities is being sent to schools and colleges in September 2008 and will be followed by an online version in 2009 www.stemdirectories.org.uk
- > **Science and technology-related teacher CPD** – Science Learning Centres – national and nine regional centres across England www.sciencelearningcentres.org.uk
- > **Mathematics-related teacher CPD** – National Centre for Excellence in the Teaching of Mathematics www.ncetm.org.uk
- > **Support for STEM-related and other specialisms** – Specialist Schools and Academies Trust www.ssatrust.org.uk

The contact details for the Lead Organisations on each of the STEM Framework Action Programmes are listed in *The STEM Framework* pages 6 to 11; whilst the STEM Programme will continue to be led by the National STEM Director, John Holman j.holman@slcs.ac.uk

Encourage other schools and colleges to take a similar approach to yours!



