NATIONAL STEM CENTRE

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York, England


NATIONAL
STEM
CENTRE


Scotland
Ireland
North East
North West
Yorkshire & Humberside
York
East Midlands
West Midland
East of England
Wales
London
South Western
South East

STEM


NATIONAL SCIENCE LEARNING CENTRE
NATIONAL
STEM
CENTRE
Science
Technology
Engineering
Mathematics
Science
Technology
Engineering
Mathematics

Organisational overview

National Science Learning Centre

Regional Science Learning Centres

National STEM Centre

Operations Teams

- National network of Science Learning Centres
- Established 2004
- 10 centres – national and nine regions
- Professional development for teachers of science and related subjects.

National Science Learning Centre

Regional Science Learning Centres

National STEM Centre

Operations Teams

NATIONAL STEM CENTRE

Science LEARNING CENTRES

National Science Learning Centre

Regional Science Learning Centres

National STEM Centre

Operations Teams

- Established 2008
- Funded by Gatsby Charitable Foundation
- Activity to support teaching of STEM subjects, predominantly through online infrastructure
- Home to the largest collection of teaching and learning resources for science and mathematics in the UK
- Also home to the ESA funded ESERO-UK

- Why ‘STEM’?
- Snapshot of science education in England
- Recent curriculum changes for science
- Students’ attitudes and progression
- STEM in schools
- Work of the National STEM Centre

Why ‘STEM’?

STEM skills are in short supply....

- Around 58 per cent of net new jobs predicted to appear in the economy between 2007 and 2017 will require employees with STEM skills.

UK Commission for Employment and Skills 2010

- 66% of employers report difficulties recruiting STEM skilled staff, with particular concern at graduate and post graduate level.

Confederation of British Industry; Education and skills survey of 350 employers 2009

.... but the picture is complex

The broader argument

... improving education in math and science is about producing engineers and researchers and scientists and innovators who are going to help transform our economy and our lives for the better.

But it’s also about something more. It’s about expanding opportunity for all Americans in a world where education is the key to success. It’s about an informed citizenry in an era where many of the problems we face as a nation are, at root, scientific problems.

Snapshot of science education in England

Education compulsory to age 16

Age range	Key stage	Notes
3-5	EYFS*	Most children begin formal education aged 4 years
5-7	KS1	Summative teacher assessments in English, and maths
7-11	KS2	Summative national tests and teacher assessments in English and maths
11-14	KS3	Ongoing teacher assessments Summative teacher assessments in English, maths and science and other foundation subjects
14-15	KS4	Minority of children take GCSEs**
15-16		Most children take GCSEs and/or vocational qualifications Minority take international qualifications

*Early Years Foundation Stage

**General Certificate of Secondary Education

STEM education

Subject	Compulsory to ...	Qualifications
Science	Age 16	Together with English these are core subjects. Almost all students take a GCSE qualification in these subjects.
Mathematics	Age 16	
Information technology	Age 16	Completion of national curriculum requirements is compulsory, but not external qualification.
Design & technology	Age 14	Students are entitled to have access to design & technology until age16, but study is not compulsory.
Engineering	Not a national curriculum subject; some students follow courses of study leading to vocational qualifications	

Age 16-18

- General qualifications (A-levels) 40%
- Vocational qualifications 28%
- Apprenticeships 2%
- NEETs* 9%

*’NEET – not in education, employment or training’

Vocational qualifications – technical routes

- A bleak and confusing landscape
- Progression to higher levels of vocational qualifications is poor
- Need to look at models across Europe, e.g. Netherlands (60% vocational routes), French BTS (Brevet de Technicien Superieur) or the German Techniker

Hilary Steedman, Centre for Economic Performance, London School of Economics and Political Science

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1993	2008
• Less than 50% of 16-18 year olds were in full time education	• Approximately 60% of 16-18 year olds were in full time education
• 16% in a job with some form of training	• 9% in a job with some form of training
• 13% NEET	• Little change in NEET figures

More choice in qualifications – less in work-related training routes

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Some recent science curriculum changes

Beyond 2000 (Millar and Osborne)

- ‘The science curriculum from 5 to 16 should be seen primarily as a course to enhance general ‘scientific literacy’.’
- ‘To speak of scientific literacy is simply to speak of science education itself.’ (DeBoer, 2000).
- ‘[Scientific literacy] stands for what the general public ought to know about science.’ (Durant, 1993).

Millar, R. & Osborne, J.J. (eds) (1998) Beyond 2000: Science Education for the Future. London: King’s College London.

DeBoer, G.E. (2000) Scientific literacy: Another look at its historical and contemporary meanings and its relationship to science education reform. Journal of Research in Science Teaching vol 37 issue 6 P582-601

Durant, J.R. (1993) What is scientific literacy? In J.R.Durant & J.Gregory (Eds.), Science and culture in Europe (pp.129 – 137). London: Science Museum.

Twenty First Century Science

- Whilst a grounding in scientific literacy can be argued as appropriate for all students, those aspiring to further scientific study, and/or a science-based career, also require more specialised training.

- The pilot project for Twenty First Century Science was major influence on national curriculum from 2006 – an increase in ideas about the nature of science (known as ‘How Science Works’)

Bananas as good as drugs for treating HIV, say scientists

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- Increase in post-16 progression for Twenty First Century Science schools:
  - Sample of 155 schools (35.7% of schools originally contacted)
  - Average increase for progression of over 30% for in all three sciences

- In broader implementation of the national curriculum an unsatisfactory specification of curriculum for the nature of science, with poor implementation of assessment for nature of science

- Future for teaching of nature of science?

Recent new government, new priorities

1 Science and mathematics education remain high on the agenda

2 Reduced spending

3 More autonomy to schools and colleges:

For example, Teaching Schools, Academies, Free Schools

4 Ongoing curriculum review

5 International comparisons of achievement

Watching:

Developments in provision of careers guidance

Recognition of importance for technical routes

National Curriculum Review

- To embody rigour and high standards and create coherence in what is taught in schools
- To ensure all children have the opportunity to acquire a core of essential knowledge in the key subject disciplines
- Beyond that core, to allow teachers the freedom to use their professionalism and expertise to help all children realise their potential

(Department for Education, 2010)

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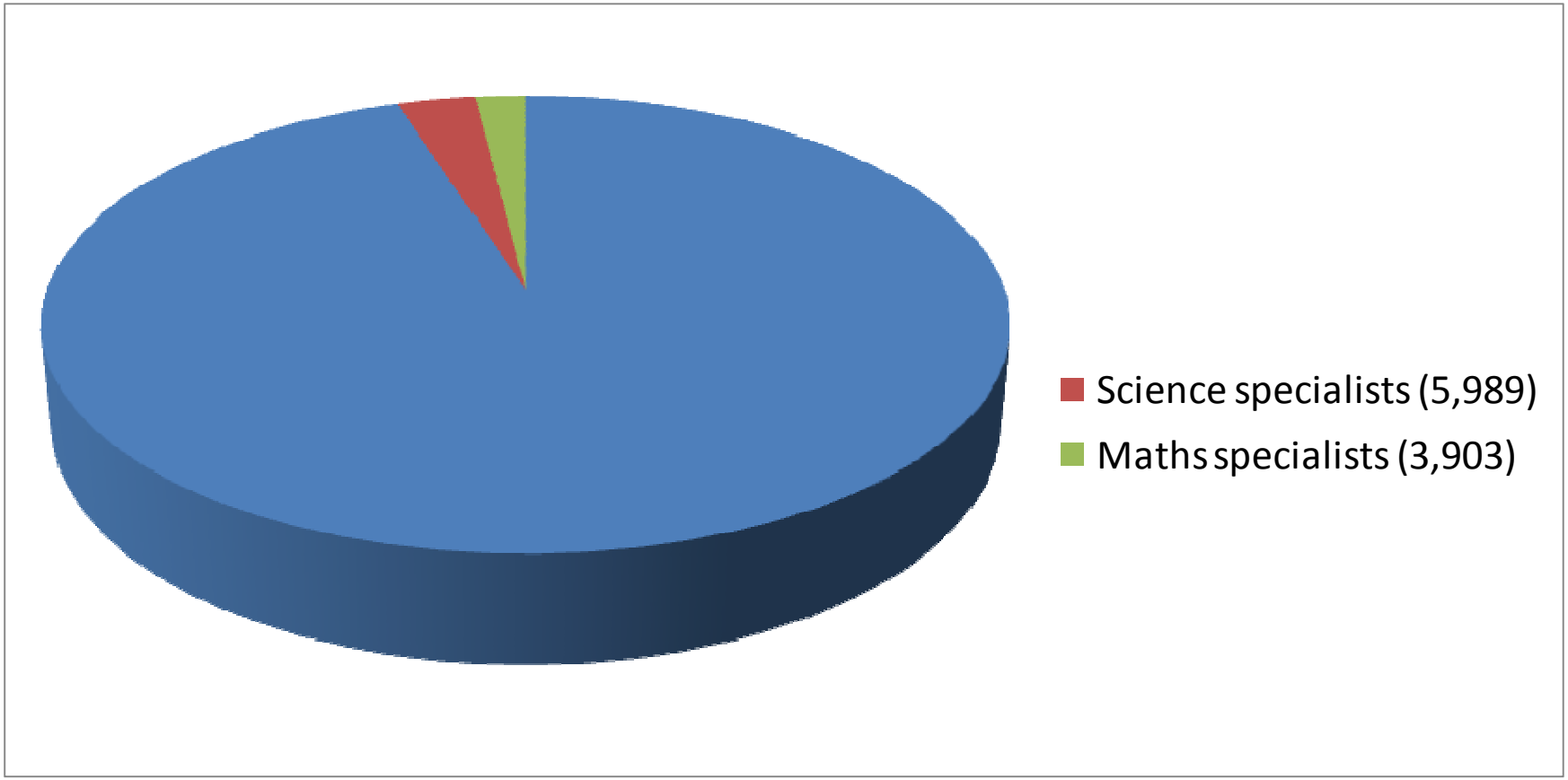
Support for non-specialist teachers

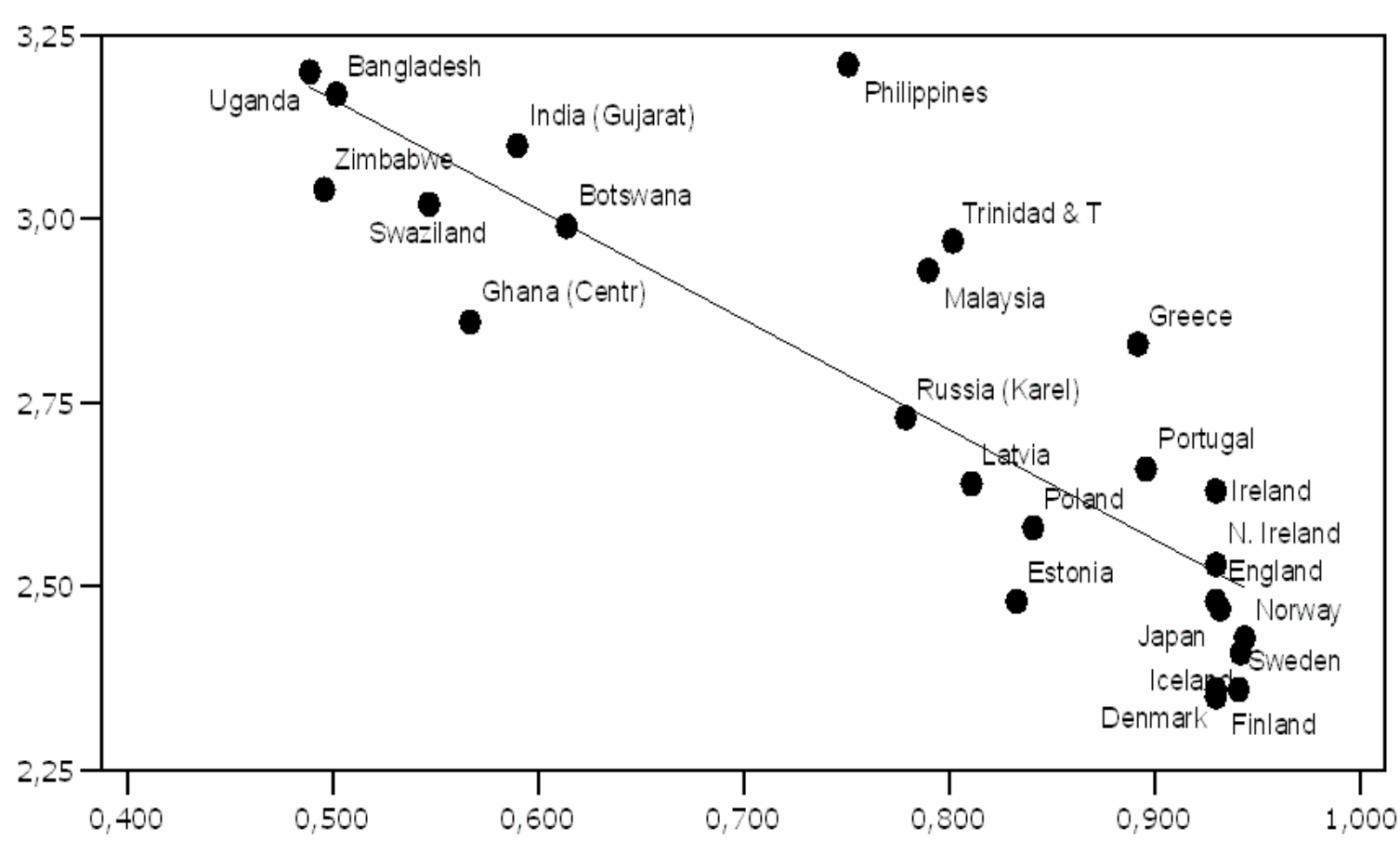
Over 17,000 primary schools in England - total workforce 189,315



(Royal Society, 2010)

What do young people think of science?

ROSE Project



Horizontal axis: Human Development Index
Vertical axis: Measurement of positive attitudes towards studying science

Svein Sjoberg, University of Oslo
[Research in England by Professor Edgar Jenkins & Nick Nelson at University of Leeds]

TIMSS 2007

England 1999 to 2007:

- Proportion of 15 year-olds with a high positive attitude:
  science 76% to 55%
  mathematics 65% to 40%

- ‘Pupils are doing well in science *(and maths)* but with relatively low levels of enjoyment.’

Trends in International Mathematics and Science Study 2007

PISA 2006

% of students agreeing with statements:	OECD average	UK	USA	Germany	Japan
Personal value of science	63	64	72	54	55
Career in science	29	25	36	26	21

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Attitudes to science: 800 students aged 14

- Two-thirds of students think science has positive influence on society.
- 25% of students think that it would be good to have a job as a scientist, but almost 33% indicate that they definitely do not want a job as a scientist.
- 80-85% of students believe it is important for the country to have well qualified scientists – though most do not want a job involving science themselves.

Judith Bennett and Sylvia Hogarth, University of York for the National Science Learning Centre. Surveys in 2006, 2007 and 2008

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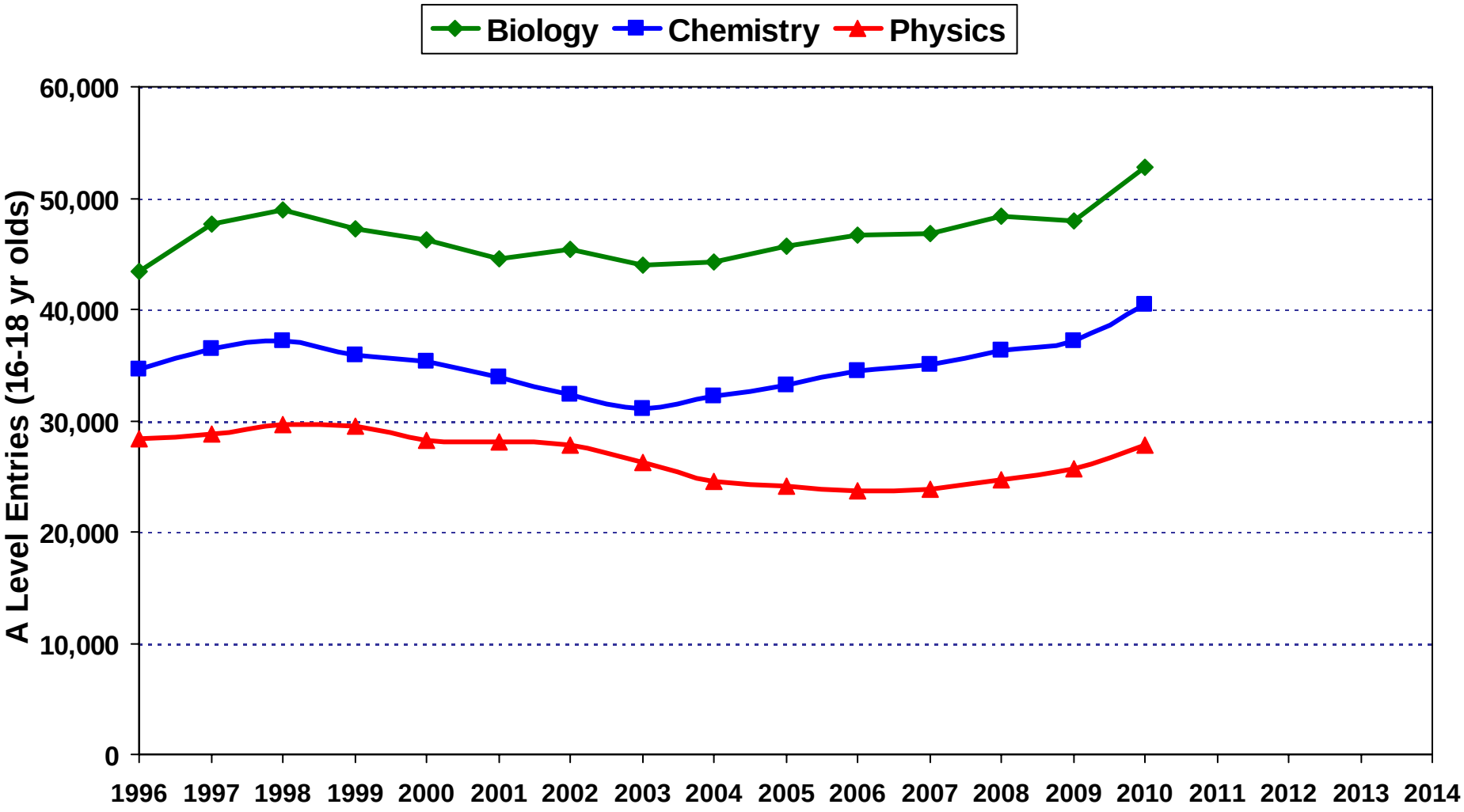
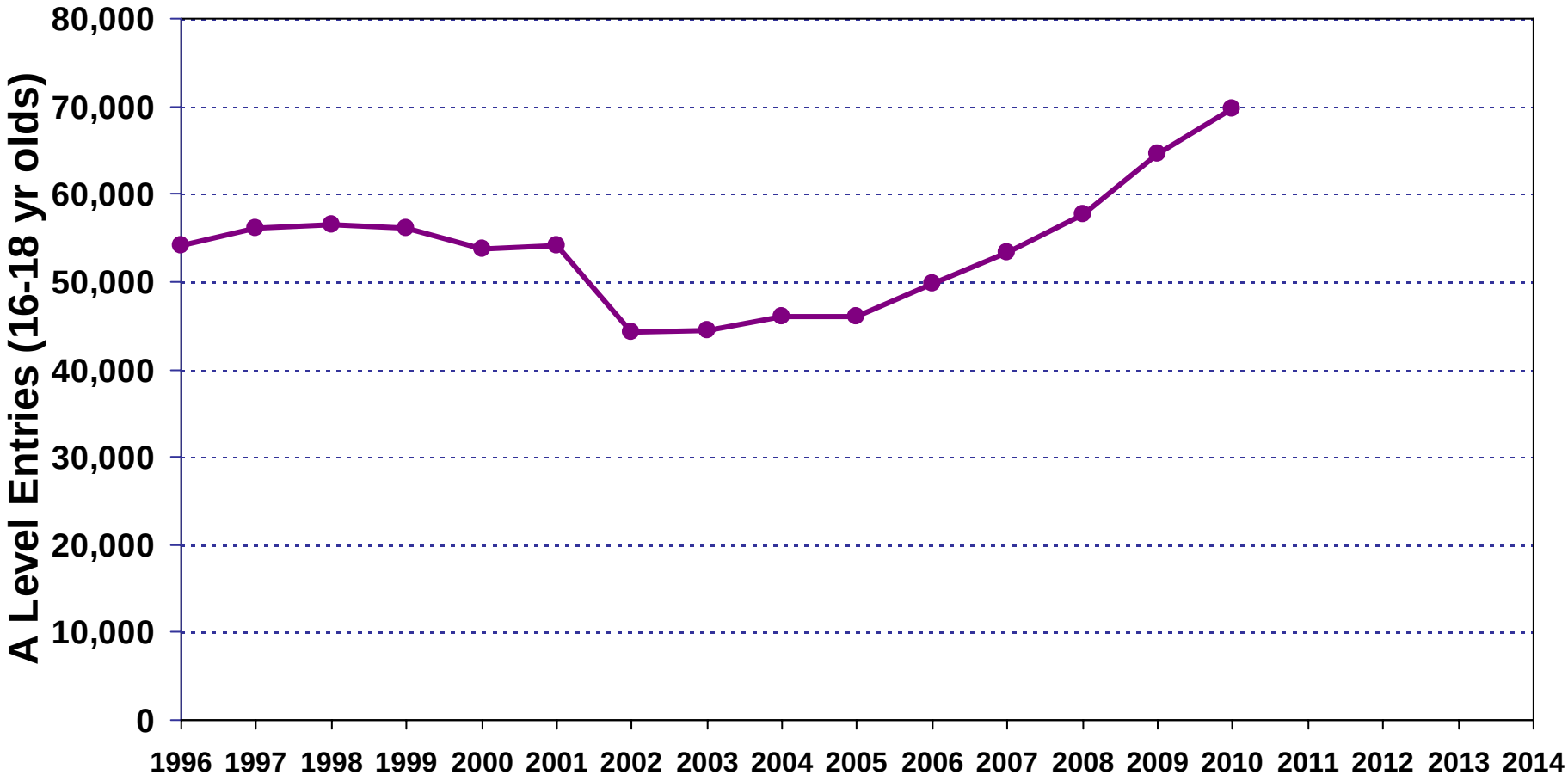
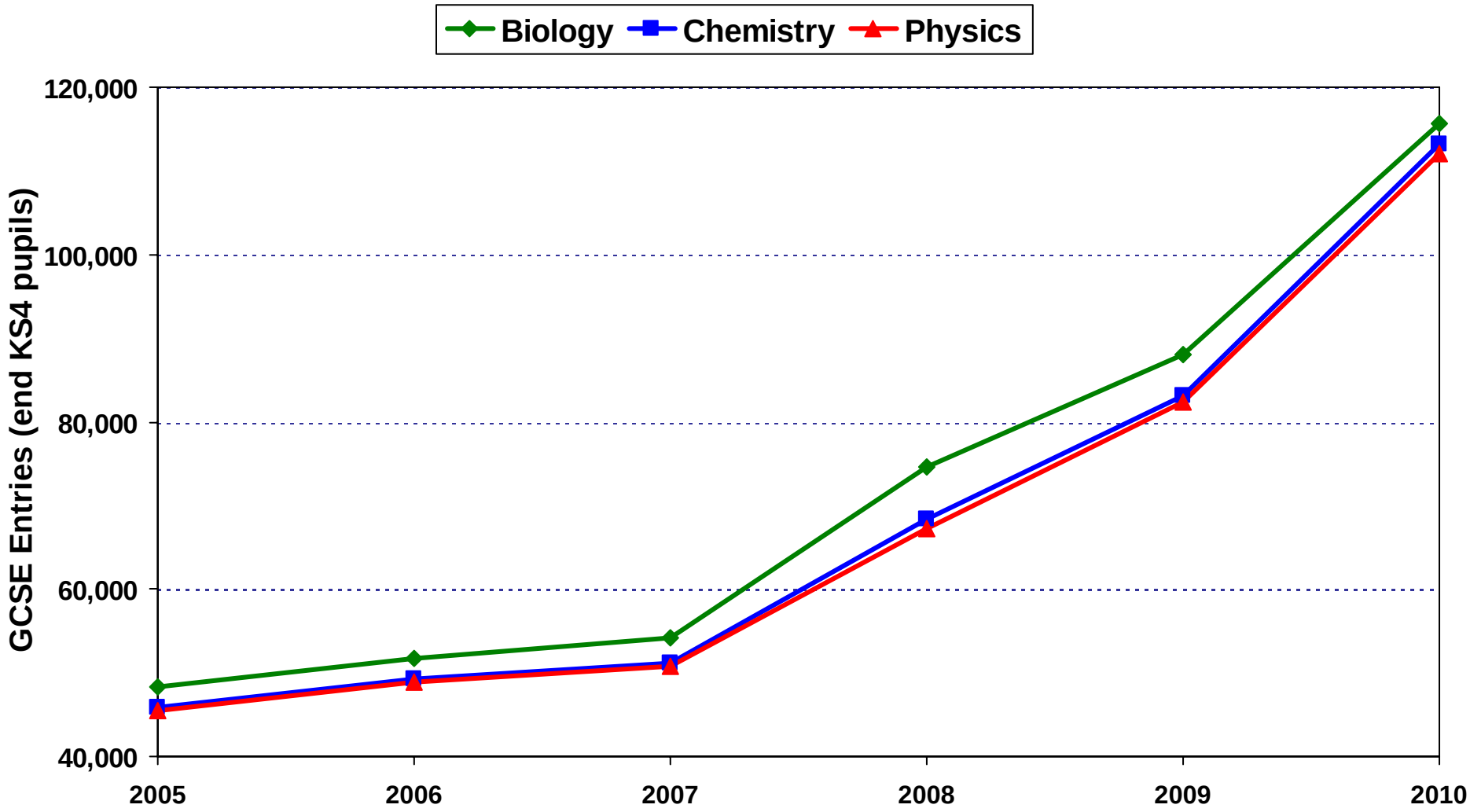
A-level entries – science subjects



A-level entries – mathematics



Separate sciences at GCSE



Gender imbalance remains for physical sciences

- GCSEs: around 650,000 candidates for science, maths, English
- A-level (2010):
  - Mathematics: 77, 001 (40.6% female)
  - Biology: 57, 854 (58.8% female)
  - Chemistry: 44, 051 (47.8% female)
  - Physics: 30, 976 (21.5% female)

See Institute of Physics research, ‘Girls in Physics’ National STEM Centre eLibrary

ASPIRES

Science Aspirations and Career Choice: Age 10-14

The **Science Aspirations and Career Choice: Age 10 - 14** project is a five year longitudinal study, funded by the Economic and Social Research Council (ESRC) as part of their Targeted Initiative on Science and Mathematics Education (TISME). The project started in 2009 and is based at King's College London. One of the main objectives of the project is to investigate some of the factors influencing the **educational choices** made by children in this age group. Particular interest focuses on the influence of peers, parents and schools, and on the role gender, class and ethnicity play in shaping these choices.

Learning about careers in science

A second component of the project is to work with teachers and other experts on an intervention that is helping us develop strategies for teaching about science-based careers in Key Stage 3.

‘STEM’ in schools

At age 14-16, students may spend 40 percent plus of the formal curriculum studying:

mathematics
sciences
design & technology
ICT & computing

STEM is a useful term to describe a group of disciplines with related economic importance.

It is *not* a prescription for particular approaches to pedagogy.

At the heart of STEM is strong subject teaching.

Alongside this teachers have a range of strategies to support young people in making the connection between subjects, and the rich range of opportunities they can lead to.

These strategies will include cross-subject working, but subject learning is not lost.

STEM subjects also offer the opportunity to develop competencies that are of value to students regardless of their future progression routes.

Areas of work at the National STEM Centre

Strategic embedding of STEM in schools

1 An ethos driven by senior leadership

2 Appropriate curriculum routes

3 Continuing professional development for teachers to support strong subject teaching

4 Enhancement and enrichment opportunities for students

5 Innovative use of the school environment

6 Access to well-informed careers-related learning for students

Timeline project

- A research approach to raising awareness and engagement with STEM subjects
- 28 pilot schools across English regions
- Mentor support for pilot schools
- School self-review and action planning for STEM
- Pupil attitude surveys (before and after)

Centre for Education and Industry (CEI) at the University of Warwick
International Centre for Guidance Studies (iCeGS) at the University of Derby
Isinglass Consultancy

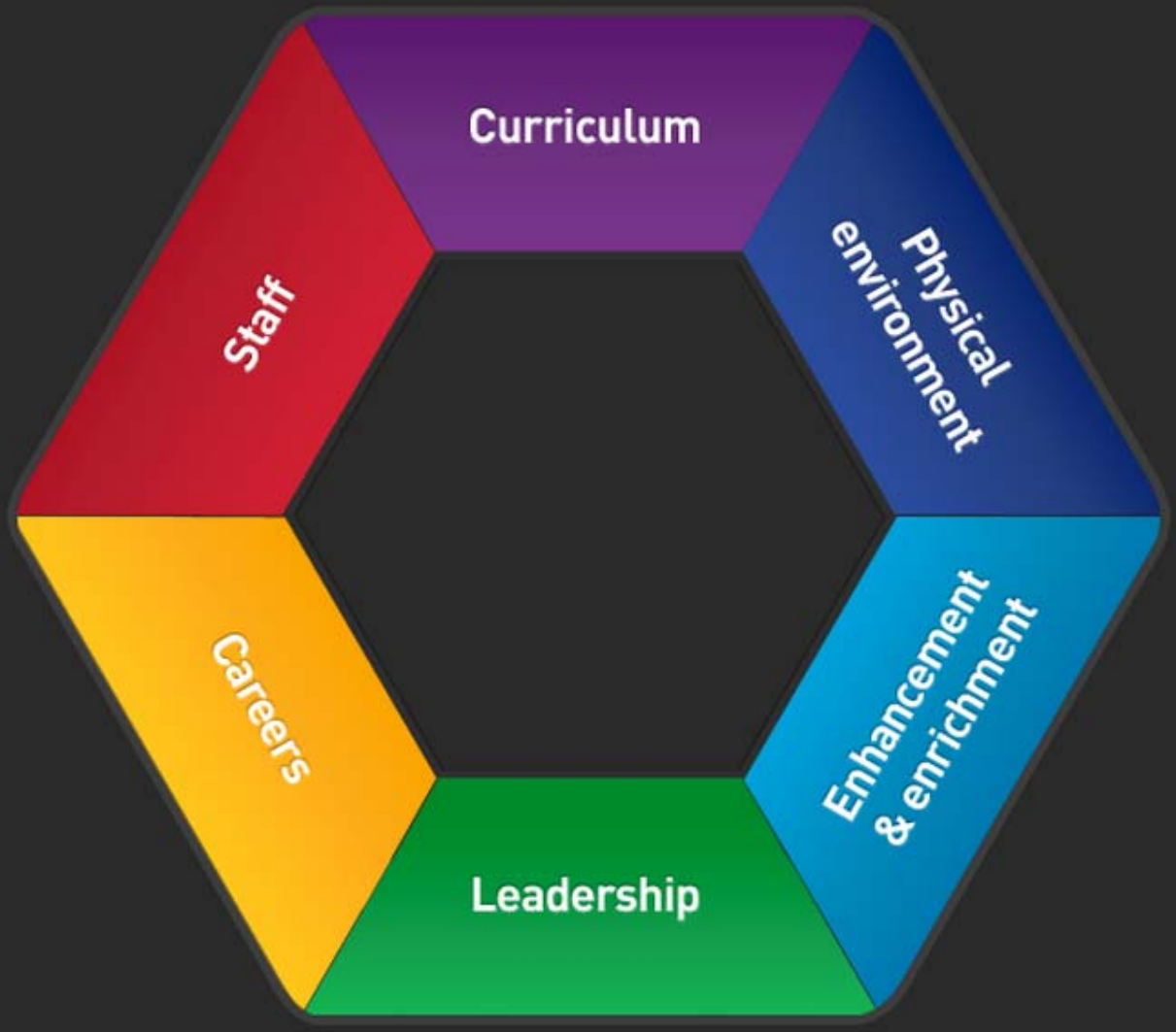
STEM Manager

How to use the STEM Manager

The STEM Manager helps your school develop an intergrated approach to STEM. No two schools are alike, so please adapt the model to fit your school's needs.

Click here for guidance on how to use the STEM Manager

Five steps to STEM



Acknowledgements


Science
Technology
Technology
Engineering

Wave Machine

Subject(s): Science | Physics | Age: 11-14 | 14-16 | Type: Video | Publication Year: 2010 to date

» Read review » Comments (15)

In this video, produced by the National STEM Centre and the Institute of Physics, Alom Shaha describes a simple but effective wave machine. Aimed at teachers, this video explains how to make the wave machine using adhesive tape, jelly babies and wooden skewers. He explains how it can be used to illustrate transverse wave motion in a visual and engaging manner.

HEALTH and SAFETY
Any use of a resource that includes a practical activity must include a risk assessment. Please note that collections may contain **ARCHIVE resources**, which were developed at a much earlier date. Since that time there have been significant changes in the rules and guidance affecting laboratory practical work. Further information is provided in our Health and Safety guidance.

» URL: http://stem.org.uk/rx43j

Add to my list | Sign in to rate or comment | ★★★★★

Downloads

This video is not available for download

Files

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Wave machine

Resource by: National STEM Centre

Collections

The resource is part of National STEM Centre, Institute of Physics

- Physics Demonstration Films
  - Wave Machine

The resource is part of British Science Association, National Science & Engineering Week

- National Science & Engineering Week
  - Wave Machine

CPD links

- **Bring science to life: csi forensics**
  National Science Learning Centre - Online CPD
- **Astrophysics - impact award**
  Science Learning Centre London - University of London Observatory, Mill Hill
- **Technicians supporting triple science - impact award**
  Science Learning Centre London
- **Working as a science technician: an introduction to the role impact awards available**
  Science Learning Centre South West - Plymouth High School for Girls
- **Learning outside the classroom: science in informal settings**
  Science Learning Centre East Midlands -

Triple Science Chemistry

Group leader(s): James de Winter

Group type: Open

In this area is a quality assured collection of the most useful resources for use in delivering the extension units of the new GCSE chemistry specifications. The first tranche are materials sourced from a teachers of chemistry in maintained schools. Overtime, it will build into an extensive collection of material directly relevant to the teaching of the extension units within GCSE chemistry.

How can you get involved? If you want the team to post resources on a specific area of the chemistry curriculum you are struggling with, let us know by posting a comment to this community or e-mail the Group Leader. If you have experience of how you might use the materials we have posted, comment on them or upload better links of your own.

+ Add a new topic

Qualitative Analysis (1 reply)

Created on 10th April 2012 09:18 by james

In this topic are resources to help you teach aspects of Triple Science Chemistry that cover content around *Qualitative Analysis*.

James replied 49 days ago :

Collected here are some of the resources produced by advisors, teachers and consultants for the previous triple science support program (courses pre 2011). Whilst there may have been some changes to the specifications since then we felt that these were well worth sharing here.

▸ View

▸ Reply ▸ View

Looking forward

‘The most important factor in a student’s experience of a subject area is their teacher.’

How the world’s best-performing schools come out on top
(McKinsey and Company 2007)

“Coming together is a beginning; keeping together is progress; working together is success.”

Henry Ford

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