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Graduates in science, technology, engineering and maths (STEM subjects) are vital for the UK's future prosperity but they are in short supply and there are challenges in recruiting students onto these degree courses. This Russell Group briefing was produced in February 2009.

Summary

- The importance of STEM skills to the future prosperity of the UK is well established. Lord Sainsbury's review *The Race to the Top* stated that:
    - "In a world in which the UK's competitive advantage will depend increasingly on innovation and high-value products and services, it is **essential that we raise the level of our STEM skills**. Policy making in many areas of government also requires a supply of creative young scientists and engineers."
- Russell Group graduates and postgraduates are meeting a significant proportion of the demand for **high-quality STEM skills**, making an important contribution to business productivity and innovation. Nevertheless there is already a shortage of high-quality STEM graduates entering the UK economy and **demand for such graduates is set to increase**.
- A recent study commissioned by DIUS, The Council for Industry and Higher Education and the Engineering and Technology Board concluded that companies and organisations that are most dependent on high quality STEM personnel will find it **increasingly difficult to find the skills that they will require** to operate and compete successfully.
- There are some significant problems earlier in the education system that need addressing in order to boost participation in STEM. A DIUS report published in January 2009[1] found that:
    - The **supply of STEM graduates is crucially dependent on the earlier supply of those with the requisite A-Level** (or equivalent) qualifications on how many continue to study STEM courses in HE.
    - Despite the increase in the number of STEM postgraduates and graduates in recent years, the number of pupils taking A-levels in maths and sciences is not keeping pace.

- The Russell Group remains concerned by the **dramatic long-term fall in take-up of many STEM subjects at school**. The number of students taking 'traditional' subjects, particularly in physical sciences and maths, has become worryingly low, despite recent modest increases:

    - **From 1989-2004, maths entries fell by 40%.** Following curriculum changes in 2006-7, the number of candidates taking maths has started to increase.

    - In 2008, the percentage of pupils taking maths (7.5%), chemistry (3.5%), biology (2.7%) and physics (2.3%) increased. However, these numbers are **still significantly below their previous levels, after almost two decades of decline**.

- Evidence suggests that school students are avoiding A-level subjects that they perceive to be 'harder', including STEM.

    - State school pupils are significantly less likely to take separate sciences and other STEM subjects, despite the fact that studying these subjects increases a student's future options. They are also far **less likely to be taught STEM from teachers with a degree in the subject**. For example, 80% of physics teachers in independent schools had a degree in physics, compared to only 30% of those in state schools.

    - **Just under half of all science A grades at A-level are from independent schools.**

- Russell Group universities are **working to increase STEM participation**.

    - Many institutions have introduced foundation years to widen participation and to prepare students who do not have the pre-requisite skills in maths and sciences to enter a degree in those fields.
    - Many institutions have **adapted the content and structure of their STEM courses**, particularly the first year, in order to address the **wide range of abilities on entry.** Some have extended STEM degrees to 4 years to allow more teaching of core knowledge and skills in the first year.
    - Russell Group universities also engage with schools, teachers, parents and local communities to **raise interest** in STEM subjects.

The importance of STEM graduates to the economy

- The Government's *Science and Innovation Investment Framework 2004-14* established the importance of STEM skills to the future prosperity of the UK:
    - "To support the UK's ambition to move to a higher level of research and development (R&D) intensity, it is crucial to ensure that the UK has the right stock and flow of skilled scientists, technologists, engineers and mathematicians, as well as technicians and other R&D support staff, generated from within the UK and attracted from abroad. A highly skilled, diverse workforce will contribute to **business productivity and innovation**, enabling UK businesses to exploit fully new technologies and scientific discoveries, achieve world-class standards and compete globally."
    - A 2002 study by the National Institute of Economic and Social Research showed that: "where the UK loses out in terms of skills levels of engineers (and scientists) and in the associated innovative activity, then a loss of competitiveness occurs."[1]

Growth in demand for STEM graduates

- A recent study commissioned by DIUS, The Council for Industry and Higher Education and the Engineering and Technology Board identified benchmark projections of employment of STEM graduates using data from the Labour Force Survey[2]. The study concluded that:
    - The continued shift towards a knowledge-intensive economy is expected to **increase demand** for STEM graduates and postgraduates.
    - The demand for most STEM subjects is likely to grow faster than for other disciplines over the coming decade.
    - Companies and organisations that are most dependent on high quality STEM personnel will find it **increasingly difficult to find the skills that they will require** to operate and compete successfully.

- The fact that employers are willing to **pay a premium for STEM graduates** is further evidence of their value and the high level of demand for such skills:
    - STEM graduates tend to have **higher earnings** than non-STEM graduates.
        - STEM graduates tended to earn higher salaries: 43% of graduates in STEM subjects were earning £25,000 or over 3.5 years after

[1] G. Mason and K,. Wagner, National Institute of Economic and Social Research, "Skills, Performance and New Technologies in the British and German Automotive Component Industries", July 2002. See the Engineering Council (UK) and the Engineering and Technology Board (etb), *Digest of Engineering Statistics 2003-04*, July 2004

[2] *The Demand for STEM Graduates,* DIUS, CIHE, ETB and IER, January 2009

graduation, compared with 30% of arts and humanities graduates[3].

- 49% of STEM graduates work in science occupations 3.5 years after qualifying[4], where they can earn an even greater wage premium than other graduates (average salaries for STEM graduates in science occupations are £36,000 compared with £32,000 for those in non-science occupations)[5]
- Chemistry and physics graduates can expect to earn over their lifetime approximately £185,000-£190,000[6].
- Individuals lacking mathematical skills stand to lose £136,000 in income over a lifetime on average, costing the UK economy £9 billion since 1990[7].

- As many employers seek to reduce costs during the recession, traditional graduate recruiters are, in some cases, reducing their vacancies. Yet demand for STEM graduates remains high. A recent report from the Association of Graduate Recruiters found that engineering vacancies were likely to increase by 8.3% for 2009, despite significant decreases in other sectors[8].

Recruitment difficulties in STEM already exist

- Employers find that there are specific recruitment difficulties for certain STEM-related sectors.

- The CBI Education and Skills Survey 2008, which surveyed over 600 employers of all sizes and sectors in England reveals that:

    - **Almost one in four reported that they had experienced difficulties in recruiting STEM graduates**, rising to one in three for 'experienced graduates'. Firms in the energy, water and manufacturing sectors expressed particular difficulties in recruiting STEM graduates.

    - **30 percent of respondents believed the number of STEM graduates was a barrier**.

    - 94 percent of banking firms and 61 percent of professional services companies employ STEM graduates in financial positions.

    - Large firms are increasingly looking overseas to recruit STEM-qualified staff.

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[3] 1994 Group (2008). *Graduate Employment and Earnings: are universities meeting student expectations?* London: 1994 Group.
[4] DIUS, *The Demand for STEM Skills*, Jan 2009.
[5] *The Demand for STEM skills;* Ibid
[6] PricewaterhouseCoopers (2005). "The economic benefits of higher education qualifications". Rates of return in comparison with those that left school with only two 'A' levels.
[7] Kounine, L (2008). "The value of mathematics". London: REFORM.
[8] AGR graduate recruitment Winter Survey 2009: http://www.agr.org.uk/news/agr_in_the_news/id.100.html

A shortage of STEM graduates entering the economy

- The engineering sector is a major recruiter of STEM graduates. A survey based on 444 engineering companies and 81 universities[9] found that:
    - Industry requires engineering graduates with excellent technical skills, a high standard of mathematics and broader skills such as communication ability and team working.
    - The number of university entrants to engineering remained static between 1994 and 2004, even though total university entries rose by 40%.
    - **Engineering courses are seriously under-funded,** and this risks constraining innovation in learning and teaching.
    - UK engineering faces a serious shortage of graduates. Unless action is taken, the shortage of high quality engineering graduates could have serious repercussions for the UK industry.
    - Universities welcome the idea of closer collaboration with industry to improve quantity and quality of engineering graduates.
- Evidence from the pharmaceutical industry on sustaining the 'skills pipeline' in the pharmaceutical and biotech industries[10] concludes that there remain difficulties in recruiting sufficient numbers of STEM trained graduates. This is particularly apparent in many core disciplines such clinical pharmacology, experimental medicine and pharmacokinetics.
- A study by the Royal Society identified that **the proportion of UK students on STEM postgraduate courses has not been increasing as fast as overseas students on these courses**, and that this trend could lead to longer term skills shortages within the UK[11].

Russell Group graduates and postgraduates are meeting demand for high-quality STEM skills in key areas

- Russell Group universities make a major contribution to the supply of STEM-qualified graduates in the UK:
    - While our universities account for just 11% of UK HEIs, **almost 30% of STEM graduates qualified at Russell Group universities.**[12]
    - **This includes 82% of graduates in medicine and dentistry.**[12]

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[10] ABPI (2008) "Skills needs for Biomedical Research": http://www.abpi.org.uk/publications/pdfs/2008STEM_Skills_Report.pdf

[11] Royal Society, A Higher Degree of Concern, 2008

[12] HESA Destinations of Leavers survey, 2005/06

- **Russell Group postgraduate courses are meeting skills gaps in some key areas for Government and industry**. Russell Group institutions accounted for nearly 80% of doctoral graduates in clinical medicine, pharmacy and pharmacology, chemistry and engineering - all areas highlighted as economic priorities in a recent report by the Association of the British Pharmaceutical Industry (ABPI).[13]

- As demand for engineering graduates continues to increase[14], Russell Group universities continue to make a vital contribution to the UK's engineering skills base:

    - 36% of UCAS accepted applicants to engineering courses were based at Russell Group universities.

    - However, **74% of undergraduates registering on professionally accredited courses were studying at Russell Group institutions**[15].

    - These figures are reflected in the fact that a **disproportionate number of Russell Group engineering graduates go on to be employed in a professional occupation**.

Problems exist earlier in the education system:

- The Russell Group remains concerned by the **dramatic long-term fall in take-up of many STEM subjects in school**. Numeracy is essential for many undergraduate courses at Russell Group universities, particularly in courses like engineering, economics and medicine

- The **supply of STEM graduates is crucially dependent on the earlier supply of those with the requisite A Level** (or equivalent) qualifications and how many continue to study STEM courses in HE[16].

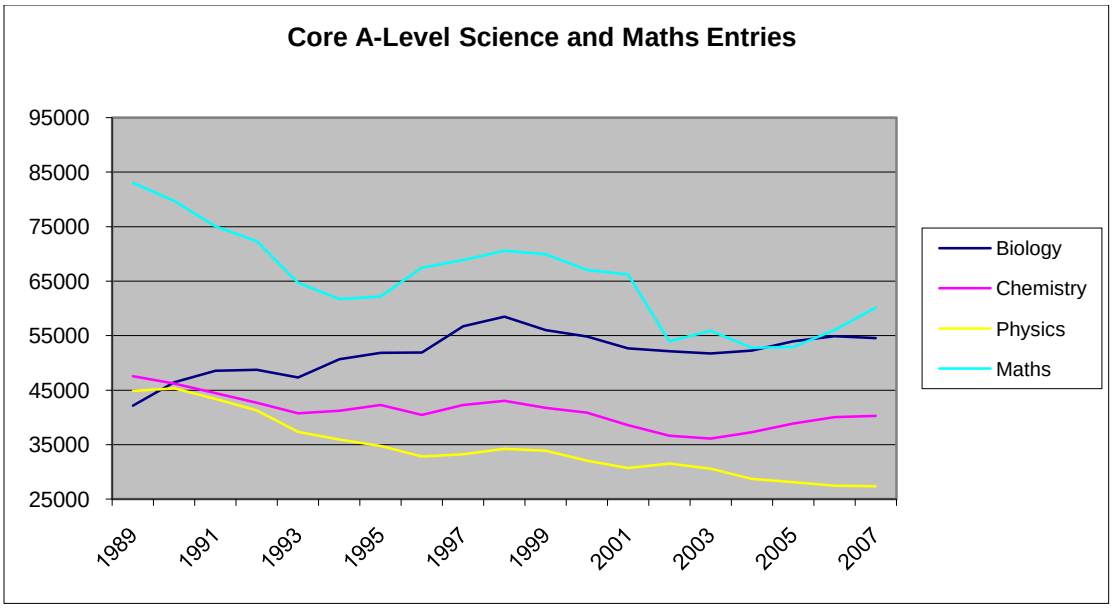
- Students taking 'key' subjects such as physical sciences and maths, have become worryingly low despite a few recent trend-bucking increases.

[13] *Sustaining the skills pipeline in the pharmaceutical and biopharmaceutical industries;* ABPI 2005

[14] AGR graduate recruitment Winter Survey 2009; Ibid

[15] The Institute of Engineering (IET) accredits engineering courses according to whether they provide some or all of the educational requirements for a student to obtain a charter in their chosen field of engineering. The IET have estimated that only around 60% of courses nationwide are accredited, which is likely to include 100% of courses at Russell Group Universities.

[16] DIUS, *The Demand for STEM Skills*, Jan 2009.



- Although there have been some recent improvements, from 1989-2007 entries have fallen by 28% in maths, 39% in physics and 15% in chemistry **despite total entries soaring 25%.**

- **From 1989-2004, maths entries fell by 40%.** Following curriculum changes from in 2006-7, the number of candidates taking maths has started to increase.

- In 2008, the take-up of maths rose by 7.5% while science subjects saw growth in the number of number of students taking chemistry (3.5%), biology (2.7%) and physics (2.3%). However, these numbers are **still significantly below their previous levels after almost two decades of decline**.

Students are avoiding A-levels deemed to be more difficult

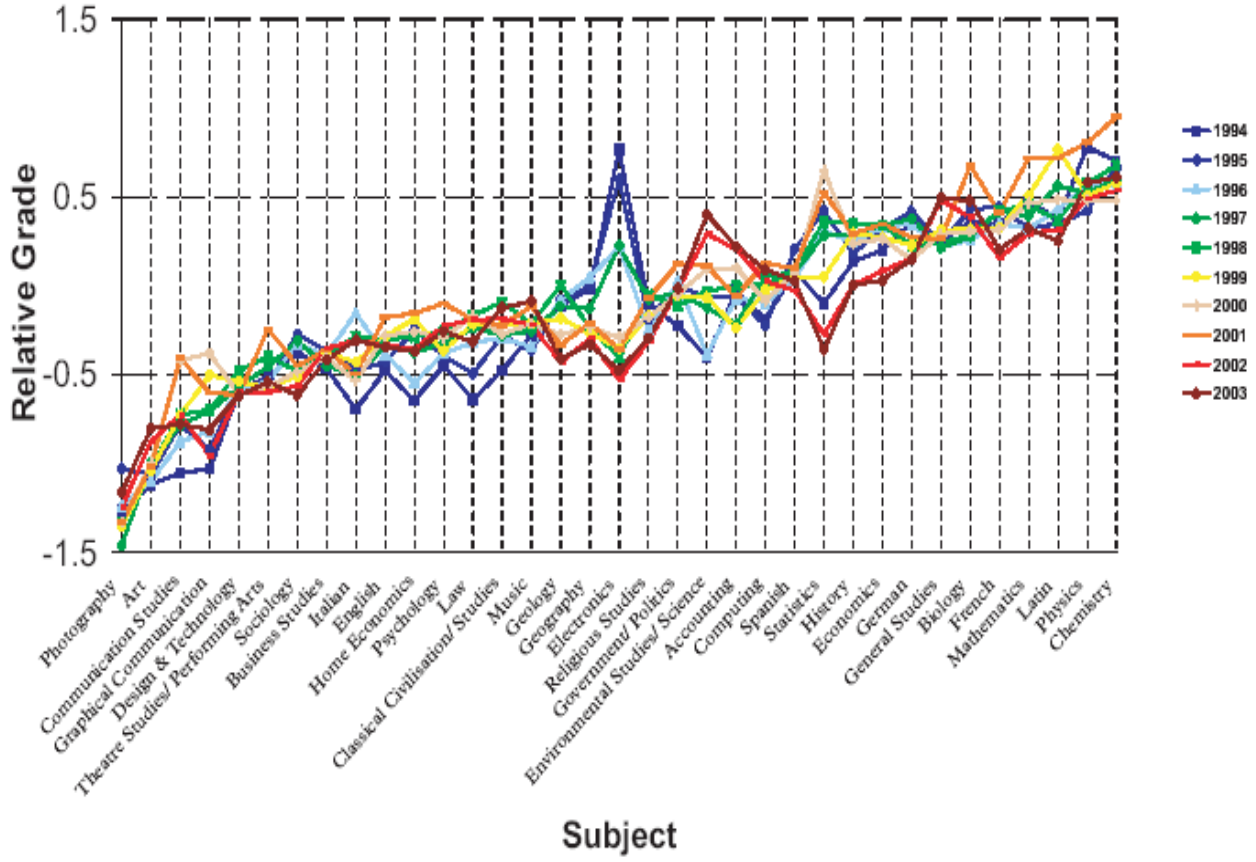
- A 2006 survey of 500 students found that 70% of 6th-form pupils believed it was harder to get an A-grade in science subjects than those that they perceived to be 'softer' options. For 2/3 of respondents, the **perceived level of difficulty between subjects was a key factor in deciding whether to take A-level science**.

- Dr Robert Coe, Director of the educational evaluation group at the Centre for Evaluation and Monitoring, said that **students avoid subjects perceived as being hard at A-Level in favour of ones where they had more chance of getting top grades**[17].

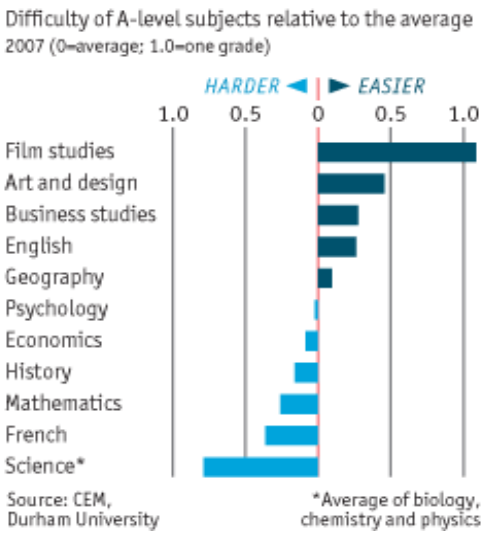
[17] Durham University's Curriculum, Evaluation and Management (CEM) Centre analysed data from nearly one million schoolchildren sitting GCSE and A-level exams and reviewed 28 different studies of cross subject comparison conducted in the UK since 1970.

- The relative level of difficulty of subjects has been analysed by the Centre for Evaluation and Monitoring. The research has found that students with a GCSE B in History, Economics, Geography, English, Sociology and Business Studies average a grade C in those subjects at A-Level; those with a GCSE B in Maths, Computing, German, French, Chemistry, Physics and Biology average a D at A-Level. See graph below.[18]

Relative difficulty of A-level Subjects:



[18] 'A-Level Subject Difficulties' CEM Research, Durham University.



The Economist recently noted that in the UK "**the widespread perception that sciences are particularly difficult turned out to be correct** – and the order in which subjects were ranked matched closely the perceived preferences of selective universities"[19].

Subject choice affects future options and rates of return

- Subject choice at school can be crucial to maximising a young person's life chances. Students must be given quality information, advice and guidance when they are selecting a combination of subjects at A-level that will equip them for their chosen university course.

- Students who take maths A-level are not only equipped to take a range of courses at university, they also **earn, on average, up to 11% more than their peers who do not take maths beyond the age of 16**.

- In addition, **graduates in STEM subjects were more likely to achieve graduate level jobs** than those graduating in Arts and Humanities subjects. 74% of STEM graduates were found to be employed in graduate jobs 3.5 years after graduation compared with 65% of graduates in Arts and Humanities[20].

State school pupils are less likely to take STEM subjects

- A-level science candidates are concentrated in a small proportion of schools. As the Royal Society noted, "science take-up is strongly skewed at present, with **half of all A-level entries in science coming from just 18 per cent of schools**."[21]

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[19] The Economist (2008). "University Applications: Getting In": 18 December 2008, based on Coe, Robert et al (2008). Are footnotes consistent? "Science Community Supporting Education: Relative difficulty of examinations in different subjects". Centre for Evaluation & Monitoring, Durham University.

[20] 1994 Group (2008). *Graduate Employment and Earnings: are universities meeting student expectations?* London: 1994 Group.

[21] http://www.publications.parliament.uk/pa/ld200506/ldselect/ldsctech/257/25705.htm

- **Separate science at GCSE is an important stepping stone to progression and success in A-level sciences**. Pupils who take separate science at GCSE are more likely to take STEM subjects at A-level and are 76% more likely to get an A or B grade in A-level science compared to those who take double-science.[22]

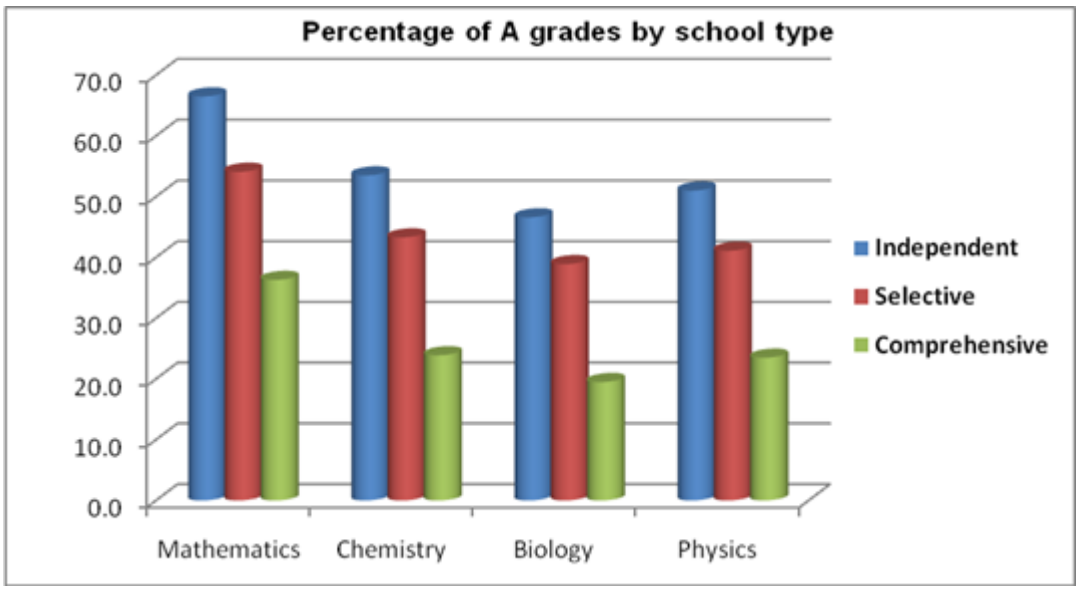
    - 86% of pupils at independent schools achieve a good grade (A*-C) in at least one science GCSE and 28% of those who were at independent schools aged 15 go on to take a science A-level. This compares to figures for non-selective state schools of 47% and 7% respectively.[23]

    - In 2005, only 27% of maintained schools offered separate 'triple science' at GCSE. While this increased to 32% in 2007, **less than one third of state schools provided the opportunity of taking all three sciences**.

    - Independent schools provide over 30% of entries to the separate sciences but over 50% of the A* grades.

- It is overwhelmingly **state students who are dropping STEM subjects at A-level**. This makes it increasingly difficult for The Russell Group to recruit large numbers of state school pupils into these key subjects where there is still high demand and stiff competition for places. This is a significant barrier to widening participation to Russell Group universities.

- Independent and grammar school students are far more likely to take traditional subjects, such as STEM, and more likely to get the top grades in those subjects**. Just under half of all science A-grades are achieved by pupils in independent schools**.



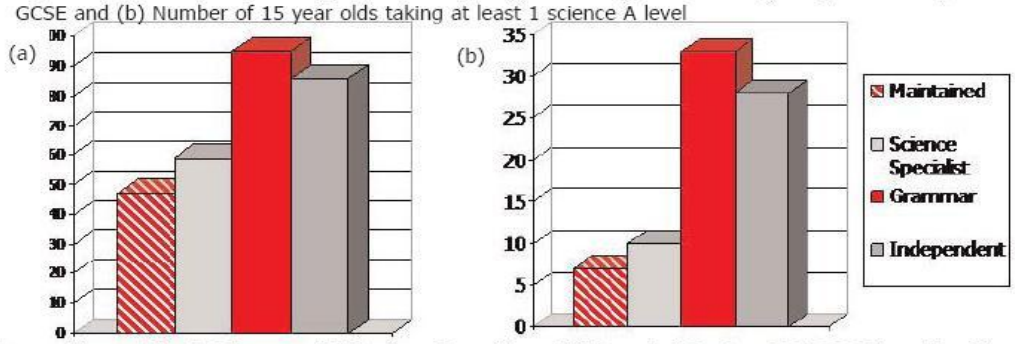
[22] Prime Minister's Strategy Unit (2006): Participation and Achievement in UK's Science Education.

[23] *Minutes of Evidence taken before the Science and Technology Committee*, Wednesday 28 June 2006, pp.12-13. Published in: House of Lords Science and Technology Committee (2006), *10th Report of Session 2005–06: Science Teaching in Schools (Report with Evidence)*. Available from http://www.publications.parliament.uk/pa/ld200506/ldselect/ldsctech/257/257.pdf

- Students are roughly three times more likely to be doing further maths if they are at an independent school. 35% of further maths entries are in independent schools compared to 15% on average across subjects.

- Only 1 in 10 students take 1+ science A-level in mainstream and science specialised schools compared with 1 in 3 at grammar and independent.

Figure 2. Performance shown by place of study as (a) Percentage of students gaining A*-C in any science GCSE and (b) Number of 15 year olds taking at least 1 science A level



Source: House of Lords Science and Technology Committee, 10th Report of Session, 2005-06, Science Teaching in Schools. Evidence from the DfES

Teachers and classrooms

- In 2005, roughly **80% of physics teachers in independent schools had a degree in physics, compared to only 30% of those in state schools**[24]. Almost one in four secondary schools in England no longer has any specialist physics teachers[25].

- 22% of physics recruits to independent schools had firsts compared to 13% of those going to the state sector and they were much more likely to have received their degree from selective universities[26].

- Over **30 percent of those teaching mathematics in school do not have a post A-level qualification in the subject**[27].

- More than half (56%) of training teachers are **forced to retake their basic literacy and numeracy exams** annually in order to pass. Last year, 35,150 trainees took 46,460 tests[28].

[24] Smithers, A and P. Robinson (2005). "Physics in Schools and Colleges: Teacher Deployment and Student Outcomes". Centre for Education and Employment Research, University of Buckingham.
[25] IBID
[26] Smithers, A and P. Robinson (2008). "Physics in Schools IV: Supply and Retention of Teachers". Centre for Education and Employment Research: University of Buckingham.
[27] Smith, Adrian (2004). *Making mathematics count*.
[28] Written Answer to a Parliamentary Question, 6 October 2008. Question 223714. Answer from Jim Knight MP
http://www.publications.parliament.uk/pa/cm200708/cmhansrd/cm081006/text/81006w0109.htm

- Only one in 100 teacher candidates fails Initial Teacher Training (ITT) in the UK. Teachers in the UK are drawn from the top 30% of graduates, compared with Finland, who draw on the top 10%, and South Korea, the top 5 %[29].

- In international studies of student attainment, the UK ranks 13th among 30 countries in reading, 18th amongst 30 countries in maths, and 9th out of 30 in science[30]. Attainment in English, sciences and maths has shown a levelling off since the late 1990s, particularly in Key Stages 2 and 3[31].

Russell Group universities are working to increase STEM participation

- The University of Birmingham has been chosen to host the National Higher Education STEM Programme, a HEFCE-funded initiative to increase the number of graduates with skills in these disciplines to fulfil the needs of employers and boost the UK economy. To **address the government's high-level skills agenda**, it will develop innovative and transferable programmes and initiatives for increasing and widening participation in the STEM subjects in higher education.

- A **foundation course** is an additional year at the beginning of a degree which prepares students without the standard required qualifications for their chosen course. These rigorous programmes ensure that they will have the necessary skills, experience and knowledge to succeed in their degree. They are specifically designed to provide additional support and tuition to students in their transition to higher education, **particularly into STEM subjects.** *(See Appendix 1 on examples on supported entry routes into Russell Group universities).*

    - For example, University College London provides a Foundation Year in Engineering as part of a four-year degree programme in engineering. This is **specifically designed for applicants who have not studied suitable subjects prior to entry** but have attained the required academic level. The first year is an introduction to mathematics, physics and engineering principles.

- Some universities **have extended their STEM degrees to include a fourth year in order to ensure that students have the necessary knowledge and understanding to succeed on the course.** David Robb**,** Chairman of the Undergraduate Admissions Committee at Imperial College London has stated "we do not do many three-year degrees at Imperial-most of ours are four years and medicine is six years ... The change in background knowledge means that we have had to extend most of our courses from three to four years."[32]

- There are numerous examples of Russell Group universities **adapting the content and structure of their STEM courses**, particularly the first year, in

[29] Margo, Julia et al (2008). "Those Who Can?" London: IPPR.
[30] OECD (2006). PISA project: http://www.pisa.oecd.org/redirect/
[31] Sodha, S. and J. Margo (2008). "Thursday's Child". London: IPPR.

[32] Robb, David. House of Commons' Children, Schools and Families Committee. June 2008: http://www.publications.parliament.uk/pa/cm200708/cmselect/cmchilsch/c651-ii/c65102.htm

order to accommodate changes in the knowledge and skills incoming students possess.

  - Different teaching approaches and different assessments are used to support the streaming being implemented at the University of Liverpool **to cope with the wide range of their mathematical skills and knowledge of students on entry** to these degree programmes. Students are now taught their Year 1 maths topics in two different cohorts, streamed according to initial maths ability, and using different approaches in terms of the depth of understanding expected.

  - The University of Leeds has introduced streaming of first year undergraduate physicists into two groups. The aim is to provide more effective teaching and mathematics support that will **get students up to speed** and prepared for their second year

  - At the University of Edinburgh, all first and second year engineering students are now taught mathematics by the mathematics department. One course is taken by the majority of students to give them a standard background in mathematics. Another **operates at a more remedial level** for students with a C in Higher Grade mathematics, D in A level mathematics or other qualification.

  - The University of Cambridge teaches Mathematical Methods to third year students as part of a four-year degree in Materials Science and Metallurgy. Mathematical Methods is designed to enable all students **to handle the mathematical content of the course**.

- Many of our universities are also introducing online resources for students:

  - The Metric programme at Imperial College London consists of online activities, tutorials, self-test exercises, and residential tutorials for AS, A2 **and first year undergraduate students** in mathematical subjects. The aim is to help students achieve the grades that they need to study at Imperial; and to help them progress when they get there.

  - The 'Guide to Effective Learning' website at the University of Birmingham offers resources and information to help students improve their study skills. Resources include **subject-specific study skills in maths and science** and technology (including physics and chemistry).

- **Russell Group universities also engage with schools, teachers, parents and local communities to raise interest in STEM subjects.**

  - For example, the Cambridge Science Festival is an annual event aimed at **promoting public engagement in STEM**. The 2008 festival saw a total of 30,000 visitors attend over 130 events over 11 days. Events included a talk on 'the Science of Dr Who', a kite building event, and a 'Rocket Car Derby'. The festival drew support from diverse sponsors, including the Wellcome Trust, Microsoft Research, The Medical Research

Council and the Society of Chemical Industry and was awarded the Directory of Social Change national Public Body Award in June 2008.

- In an **aim to raise attainment of STEM in school,** Imperial College London runs Inspire ("Innovative Scheme for Post-docs in Research and Education"), sponsored by GlaxoSmithKline. It allows post-doctoral research assistants from science, engineering and medical related disciplines to be employed on two-year contracts at schools affiliated to the Specialist Schools Trust in Greater London, as part of their bid to gain specialist science status. These post-doctoral researchers spend half their time in partner schools teaching the science curriculum while working towards qualified teacher status. The remainder of their time is spent doing research, as agreed with the University.

- Cardiff University runs a Women in Engineering programme, which brings 140 year-10 girls from schools across southeast Wales to attend activities at the schools of physics and engineering. The event is aimed at **raising awareness of engineering opportunities for women**.

- Cloth-worker bursaries in maths are available for Aimhigher students studying A-Level Maths in London. The bursary funds their attendance at two Saturday workshops per term at Imperial College London. The workshops allow students to have additional support in any maths topics they are studying. In addition the bursaries help Aimhigher students to become more confident about their maths ability and **support their aspirations to continue to study maths and related degrees**. The programme is supported by Imperial College Maths undergraduates.

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Appendix 1: Special entry routes for non-traditional students at Russell Group universities

A foundation course is an additional year at the beginning of a degree which prepares students without the standard required qualifications for their chosen course. They are designed to help these students 'catch-up' with the students who have entered a course through a conventional route. These rigorous programmes ensure that they will have the necessary skills, experience and knowledge to succeed in their degree. They are specifically designed to provide additional support and tuition to students in their transition to higher education.

University of Birmingham	Birmingham offers **foundation years** in various science & engineering disciplines. Successful completion of the course guarantees students a place on their chosen degree programme. Foundation year courses are suitable for those whose qualifications are not recognised for direct entry to a degree programme, including mature students.
Cardiff University	**Engineering, Medicine & Dentistry Preliminary Years** are designed to give students the necessary basic knowledge to enable them to cope on an engineering or dentistry degree at the University. Students who successfully complete the year will then be able to move on to the degree programmes.
University of Edinburgh and University of Glasgow	**SWAP (Scottish Wider Access Partnership)** is a partnership of further and higher education institutions, which creates opportunities for mature students with no qualifications to access university. The SWAP programme prepares students for entry into higher education and guarantees them a place at a college or university if they complete the programme successfully.

King's College London 	**Extended Medical Degree Programme (EMDP)** is a six year degree programme launched in 2001 to encourage students from disadvantaged backgrounds to become doctors. Places on the programme are offered to talented pupils from targeted inner London boroughs that have the potential to succeed in medicine but not the predicted A-Level grades required for the standard medical programme. These places are additional to those previously allocated to King's for entry by conventional routes.
University of Leeds 	**Interdisciplinary Science Foundation Year** (for science, engineering and math courses) enables students without standard entry qualifications to progress on to a wide range of science, computing, engineering and healthcare degrees at the University. The foundation year provides students with a solid academic base in science and mathematics.
University of Liverpool 	Liverpool runs various **1+3 and 2+2 foundation courses with local FE colleges** as progression opportunities into university degrees. These include degree programmes in medicine and dentistry, science and engineering, computer science and information systems, earth sciences, geography, mathematics and physical sciences.
University of Manchester 	Manchester's runs three **foundation year programmes in life sciences, medicine & dentistry and engineering & physical sciences**, which consist of a one-year programme designed to improve students' scientific knowledge to a level that is suitable for a degree in those fields. This programme is geared towards students with non-traditional qualification and those who have slightly underachieved in their science A levels.
University of Newcastle 	**Foundation Year** provides an introductory year to a number of engineering, science and mathematics degree courses, designed for those who have shown that they have the ability to succeed but lack the necessary qualifications to enter the degree directly.
University of Nottingham	**Science & Engineering Foundation Years** are

	designed for students whose school qualifications do not meet the current admissions' requirements for entry to undergraduate programmes. The programme provides grounding in the fundamentals of science and mathematics. In addition to classroom and laboratory activities, all foundation students are allocated a personal tutor to provide advice and guidance.
Queen's University Belfast	The **Highway to Science and Engineering Programme** is a one year programme designed to provide those from disadvantaged backgrounds who have just failed to meet their required grades a supported route into Science or Engineering degree courses. Available for students from Discovering Queen's schools, successful completion of this foundation programme leads to the awarding of a Foundation Certificate and entry to certain Science & Engineering courses.
University of Sheffield	**Engineering and science foundation years** are designed for those who have not studied the courses in school that would prepare them to move directly into the degree programme. They are aimed at students who, for whatever reason, need additional preparation or additional science subjects before going on to an engineering or science degree.
University of Southampton	**Foundation year** is the first year of a four or five-year programme leading to a degree in engineering, computer science, physics or geophysics disciplines. Successful completion of the year guarantees progression to degree programmes. **BM6** (Bachelor of Medicine in 6 Years) is a programme developed to widen access into the medical profession from those from disadvantaged backgrounds. It involves studying for an extra year on a specially designed foundation course before joining the students on the conventional 'BM5' programme.
University College London	**Foundation Year in Engineering** is part of a four-

UCL	year degree programme in engineering, specifically designed for applicants who have not studied suitable subjects prior to entry but have attained the required academic level. The first year is an introduction to mathematics, physics and engineering principles.
University of Warwick THE UNIVERSITY OF WARWICK	**The Higher Education Foundation Programme** is run by the University in association with two local FE colleges in business, law, science & engineering and social sciences. HEFP has a strong track record of progress to top universities. The **2+2 Degree Programme** provides a path for students to gain a degree through two years of study at a local college and a further two years at the University. This programme is specifically designed for adults who lack formal qualifications and who wish to return to education.