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Learning Routes and Pathways

General Overview

Exciting opportunities are available for young people to develop their STEM Skills and unlock talent through a range of education and training routes supporting progression onto higher level learning and employment. At Key Stage 4, in addition to vocational science courses offered by BTEC or OCR[1], young people can undertake.

- Core science (single award) GCSE
- Core science plus additional science (double award) GCSE
- biology GCSE, chemistry GCSE, physics GCSE (triple science). Take-up of the individual sciences has increased by almost 150 per cent in the last five years with a rapid increase in the numbers offering triple science. However in June 2009 just under half of all schools still did not do so, with less availability in areas of highest deprivation. Young people studying triple science are more likely to continue study at A level and achieve higher grades having done so.

Other options available include:

- The Apprenticeship route – is being expanded and strengthened
- Diplomas – combining general learning with practical hands-on experience covering a broad employment sector
- GCE A level subjects – required for entry to STEM related higher education and valued by employers and universities as indicating academic rigour, numeracy and problems solving abilities. With competition so strong for university places and jobs students need to choose their subjects wisely.
- Vocational science courses offered post-16 at entry level through to level 3 of the national framework.[2]

1. The Ofsted Report on Guidance to Students Studying Science published in May 2010 found that very few students felt misdirected at the end of Key Stage 3. However, where students embarked on vocational pathways, it was usually because teachers believed that students would achieve higher grades as a result of this method of assessment and awareness of the career implications of choices do not inform the advice offered. It is important that advice and guidance is available on progression routes including any barriers to A level progression from vocational science courses pre-16.

2. The review by Professor Alison Wolf identified improvements in vocational education 14-19 in March 2011

Apprenticeships

Apprenticeships are increasingly recognised as the gold standard for work-based training. Young people can benefit from taking an Apprenticeship through gaining increased confidence, developing skills, gaining qualifications and funded training, and getting career development. There are three levels of Apprenticeship available for those aged 16 and over:

1. **Intermediate Level Apprenticeships (equivalent to five good GCSE passes)**
   These provide the skills needed by specific industries, and allow entry onto an Advanced Apprenticeship.
2. **Advanced Apprenticeship (equivalent to two A level passes)**
   To start this programme, applicants should ideally have five GCSEs (grade C or above) or have completed an Apprenticeship.
3. **Higher Apprenticeship**
   Higher Apprenticeships work towards work-based learning qualifications such as NVQ Level 4 and, in some cases, a knowledge-based qualification such as a Foundation Degree.

Examples of Apprenticeships available in the area of STEM skills are as follows:-

Engineering and Manufacturing Technologies

- Engineering Technology
- Food Manufacture
- Gas Industry
- Marine Industry
- Nuclear Decommissioning
- Rail Transport Operations

Construction, Planning and the Built Environment
- Building Services Engineering
- Electrical and Electronic Servicing

Information and Communication Technology
- IT Users
- IT and Telecoms Professionals

Business, Administration and Law
- Accounting
- Providing Financial Services

The following quote from an Apprentice illustrates some of the benefits: Rachel Hoyle completed an Advanced Apprenticeship in Aerospace Engineering, but said that as her schooling drew to a close *"I felt unsure of what the future held. I looked into Apprenticeships and other courses, and what clinched the Apprenticeship for me was the fact that I could go and begin a career, learning from people who are experts in their own right. I felt I could get involved in real work while applying my favourite subjects, like physics and maths, and continuing to learn."*

For more details and to find a full list of Apprenticeships visit www.apprenticeships.org.uk

For case studies of Apprentices access www.futuremorph.org

- Food and Drink – Food and Drink Manufacturing Apprenticeships
- Manufacturing – Chemical, Pharmaceutical, Petrochemical Manufacturing and Refining Industries Apprenticeships
- Transportation – Rail Transport Engineering Apprenticeship

For more details and to find a full list of Apprenticeships visit www.apprenticeships.org.uk

Diplomas

The Diploma is a qualification that:

- offers a mix of general learning, creative thinking and practical hands–on experience
- involves a research–based project and at least 10 days' work experience with an employer
- covers a broad employment sector and builds essential skills while keeping all learning routes open
- has been developed in partnership with employers and higher education institutions.

The Diploma is available at three levels:

- *Foundation Diploma* – is a level 1 qualification
- *Higher Diploma* – is a level 2 qualification
- *Advanced Diploma* – is a level 3 qualification

The Diplomas most closely relating to STEM are:

- Construction and the Built Environment
- Engineering
- Information Technology
- Business, Administration and Finance
- Manufacturing and Product Design
- Creative and Media
- Environment and Land Based Studies
- Society, Health and Development

Out of 3,069 young people who completed the two year Higher Diploma, in 2010, 871 studied engineering, making it one of the most popular.

STEM A Level subjects

In terms of numbers of students studying STEM A Levels, there has been an encouraging recent increase in numbers, but from a low base compared to many non-STEM subjects. The figures for STEM subjects illustrating recent trends are as follows:

Physics – an encouraging fourth consecutive increase in numbers to 30,976 in 2010, which is back to the level of 2001 (30,701)

Maths – a significant increase in numbers from 66,247 in 2001 to 77,001 in 2010 (A Level Further Maths has increased by 11.5% on 2009 to 11,682 students in 2010)

Chemistry – a small but sustained increase in numbers from 38,602 in 2001 to 44,051 in 2010

Biology – an increase in numbers from 52,647 in 2001 to 57,854 in 2010 and still considerably higher than the chemistry or physics numbers

Other Science subjects – significant growth in A Level entrants has occurred in the past twenty years in some science subjects. For example, in 2001, **psychology** had 31,740 entrants, with an increase to 54,940 entrants in 2010. **Sports studies** has also seen a strong growth from 16,716 in 2001 to 20,612 in 2010, but with a slight decrease on 2009 numbers. It is important for young people to be aware that to enter STEM-related degrees with A Level psychology or sports studies, **they will also need to take 2 'core' science A Levels as well.**

(Source: Joint Council for Qualifications, June 2010)

The SCORE Report (2009) Choosing the Right STEM Degree Course found that students wishing to gain entry to degrees in STEM would be best advised to attain A levels or equivalent in at least two science-related subjects. The report suggests that there can be flexibility in the third or fourth A level studied. Grades and subjects studied are critical determinants of entry emphasising the importance of effective information, advice and guidance to assist young people with this vital decision. For instance, in order to study a BSc in Chemistry, most universities will expect A Level in Chemistry and in at least one more science/maths A Level.

A useful tool to assist with guidance on subject choice can be found at www.futuremorph.org by searching for Choosing Subject combinations. Students should be encouraged to check acceptable or optimum A level combinations with UCAS or individual institutions. For instance, highly competitive institutions may only accept A levels such as Applied Science or Sports Studies as a fourth subject.

The Russell Group of universities have recently published a guide to entry requirements entitled Informed Choices in partnership with the Institute of Careers Guidance that identifies the importance of STEM A levels.

STEM degree subjects

Applications

With the exception of Engineering, there has been a percentage growth in applicants to STEM degree subjects from 2002 to 2007 – with Maths (57%) and Chemistry (27%) showing above the average growth for all subjects (16%). Subject trends in numbers of degree course applicants are as follows:

Physics – has seen a 9% growth from 2002 (5,236 applicants) to 2007 (5,715)

Maths – has seen a strong 57% growth from 2002 (7,251 applicants) to 2007 (11,374 applicants)

Chemistry – has seen an encouraging 27% growth from 2002 (6,195 applicants) to 2007 (7,865 applicants)

Biology – has seen a growth of 7% from 2002 (10,670 applicants) to 2007 (11,428 applicants)

Engineering – has seen a fall of 5% from 2002 (42,841 applicants) to 2007 (40,911 applicants)

(Source: UCAS Research Team, 2008 – for DIUS (Department for Innovation, Universities & Skills))

There is a very wide range of degree courses on offer in UK universities that require STEM qualifications for entry in 2010. UCAS identifies 4,815 different degree courses.

Acceptances onto STEM degree courses

The table below indicates the number of acceptances onto STEM degree courses, and illustrates the low base of STEM degree numbers compared to more popular subjects such as psychology and sports science. A five year trend indicates a varying amount of growth in acceptances onto STEM degree courses, as shown in the table below.

Although the number of STEM graduates is lower than for many other subject areas, there is a much better chance of STEM graduates entering employment within that sector. Conversely, the number of, for example, psychology or sports science graduates entering employment directly related to their degree subject are significantly lower, as those employment sectors are much smaller.

Degree subject	Number of acceptances in 2009	Number of acceptances in 2004
Physics	3,566	2,671
Maths	6,916	4,778
Chemistry	3,966	3,089
Biology	4,686	4,641
Mechanical engineering (the largest single engineering sub-discipline)	6,275	4,753
Psychology	15,385	12,484
Sports science	10,783	7,810

(Source: Universities and Colleges Admissions Service (UCAS) 2009)

The added value of a STEM degree is the flexibility that it brings in terms of employability. The CBI/EDI Education and skills survey, 2010 found that STEM skills are valued by employers across different sectors, with almost three quarters (72%) of firms employing STEM-skilled staff. Therefore, studying STEM subjects not only maximises career options in the STEM area, but also for careers not related to STEM.