National HE STEM Programme

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HAPPY LANDINGS

An introductory guide for students considering studying a STEM subject in Higher Education




Bryan Fryer and Dr Henriette Harnisch

Contents

Authors
Bryan Fryer (University of Wolverhampton) B.S.Fryer@wlv.ac.uk
Dr Henriette Harnisch (University of Wolverhampton) H.Harnisch@wlv.ac.uk

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Birmingham
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Foreword

I am delighted to introduce to you this suite of transition and retention guides which have been produced under the National HE STEM Programme.

While increasing the supply of students to STEM Higher Education is important, ensuring that they experience a smooth transition to university and that as many as possible complete their studies successfully is of equal importance. There is a wealth of initiatives in this area that have reported on effective practice to help achieve this. The purpose of the guides is to collect and present effective practice models specifically from STEM departments. An important feature of this suite is the student perspective, which the authors have emphasised.

The issues related to induction, transition and retention are multi-faceted and therefore may have been addressed in slightly different ways in the different guides to take account of the specific context.

The suite consists of eight guides:

- Using data: an evidence-based approach to improving transition, induction and retention
- Happy landings – an introductory guide for students considering studying a STEM subject in Higher education
- STEMming the doubts – enhanced transition and induction to HE programmes
- Critical moments in the first year at university – towards a framework for effective transition
- Promoting social engagement: Improving STEM student transition, retention and success in higher education
- Improving retention: the curriculum development perspective
- Setting up a Maths Support Centre
- Optimising the part-time experience

My thanks go to the authors of the guides for distilling their knowledge and expertise and to the Steering Group for their valuable guidance. The group consisted of Professor Liz Thomas, Director for Widening Participation Research Centre (Edge Hill University), Hal Igarashi, Project Director Employer Engagement (Royal Academy of Engineering), Henriette Harnisch, Director of Academies and Trusts (University of Wolverhampton), Fiona Lamb, Associate Director (Engineering Education Centre), Ed Stevens, Regional Officer for Widening Participation and Outreach (South West) and Sadaf Alvi, Regional Officer for Higher Level Skills (Midlands and East HE STEM Anglia regional spoke).

Our collective hope is that the wealth of case studies and the student perspective presented will stimulate colleagues to consider improvements to the transition processes where they find it appropriate for their institution.

Professor Kamel Hawwash
Regional Director
National HE STEM Programme
(Midlands and East Anglia)

Introduction

Almost every organisation in the UK relies on people with STEM skills. Studying a Higher education STEM subject will provide you with the knowledge and skills valued by employers, whether or not you decide to pursue a STEM specific career.

Who should read this guide?

This guide has been written for students currently studying in Key stages 4 or 5, in England and Wales, and are considering studying a STEM subject at university or college. In this guide STEM refers to Chemistry, Engineering, Mathematics or Physics.

Why should you study a STEM subject?

Studying a STEM subject at university will provide you with critical skills needed for future employment, enabling you to access some of the most exciting and rewarding careers. Degree courses typically take three or four years to complete and are often the major access route to the STEM-based professions. Whichever subject you are planning to study at university, it is worthwhile thinking about the wide variety of options available before you make a final decision.

This booklet introduces you to some of the opportunities available at university and the reasons why you should consider a STEM subject and career. You can also read about the experiences of students who have studied these subjects, and access examples of courses and information on the routes into specific STEM subject areas. Included at the end of the booklet is a list of organisations, websites and online resources that you may find useful when considering your options.

Why STEM careers?

STEM graduates are highly sought after by employers and, with almost two-thirds of employers finding it difficult to recruit qualified staff, STEM graduates enjoy more opportunities for employment and have a higher earning potential. Over a working lifetime, these advantages can amount to as much as £108,000 more than those with just A-level or equivalent qualifications.

Chemistry, physics and maths graduates may earn on average 30% more in their working lifetime than other graduates. Engineering graduates start out earning on average £24,953, compared to £22,364 for all other graduates. It is estimated that engineering graduates can earn more than £144,000 over their working life than those with just A-levels. Futhermore, professionally registered Chartered Engineers (CEng) enjoy average salaries of £62,386 during theor career.

Almost every organisation in the UK relies on people with STEM skills. Studying a Higher education STEM subject will provide you with the knowledge and skills valued by employers, whether or not you decide to pursue a STEM specific career.

Studying a STEM subject at university or college

You may decide to study a single STEM subject or combine with another subject. Within England and Wales, universities and colleges offer a wide range of specialist degrees and many varied combinations.

A degree will most likely be a Bachelor of Science (BSc), although you may see other types such as BEng (Bachelor of Engineering) lasting three years. Another option may be to study a two or three year Foundation Degree, usually referred to as FdSc or FdEng. Foundation Degrees are higher education qualifications that combine academic study with work-based learning.

This typically takes place in the third year and is known as a 'sandwich' year. Many universities offer the opportunity to spend a year on a work placement as part of the course.

You may then wish to continue your studies by progressing into a postgraduate course such as the one-year MSc (Masters in Science). Following that, you may even consider research opportunities such as the MPhil or Doctorate (PhD), which usually takes between three and six years.

Many universities also offer the opportunity to enrol onto a four-year programme, such as an integrated Masters in Engineering (MEng) or Masters in Mathematics (MMath). The additional year contains more advanced material rather than just greater quantity. These courses are usually the type to enrol on if you wish to follow a professional career in the subject area.

Higher Education Progression Roadmap

Entry

- Level 2 qualifications – GCSEs A*-C including English, Maths and Science and
- Level 3 qualifications – AS/A Level, International Baccalaureate (IB), Advanced Diploma, BTEC National Diploma and/or Foundation year (offered at some universities)

Chemistry	Physics	Engineering	Mathematics
3 year BSc (Hons) (4 years with a sandwich year) or 4 year MChem/MSci degree courses.	3 year BSc (Hons) (4 years with a sandwich year) or 4 year MPhys/ MSci degree courses.	3 year BSc or BEng (Hons) (4 years with a sandwich year) or 4 year MEng degree courses.	3 year BA/BSc (Hons) (4 years MMath/MSci degree courses.
The Royal Society of Chemistry accredits chemistry courses which are of a high standard in terms of intellectual challenge and content. These are usually integrated Masters degree courses (eg, MChem, MSci). Accredited courses satisfy the academic requirements for the award of Chartered Chemist (CChem).	Holders of accredited degrees can follow a route to Institute of Physics (IOP) Membership and the CPhys professional qualification. Graduates of accredited Integrated Masters degrees have fulfilled the educational requirements for CPhys status, while graduates of accredited Bachelors degrees have partially fulfilled these requirements.	After completing an accredited course and relevant work experience (fulfilling the Engineering Councils Standards), you may register as a Chartered Engineer (CEng) or Incorporated Engineer (IEng).	Chartered Mathematician (CMath) status may be given following attainment of an approved MMath honours degree.
Postgraduate study including Master Degree (MSc) and Doctorate (PhD) – can be studied full time, part time or while working.			
www.rsc.org	**www.iop.org**	**www.raeng.org**	**www.ima.org**

Subject-specific information

This section will introduce you to some specific information relating to the STEM subjects covered by this guide: Chemistry, Engineering, Mathematics and Physics. If you want to find out more about these subject areas then please refer to the section at the end of this guide for links to relevant websites.

Chemistry

Chemical scientists work in a huge variety of careers both in and out of the lab, including many you might not have thought about before, such as Nanotechnology, Archeology or Marine Chemistry. About a third of chemistry graduates decide to pursue a career in the laboratory, but many do not. A chemistry degree can provide you with a whole range of useful skills and competencies that are highly valued by employers of all kinds, such as team work, analytical, problem solving, communication and numeracy skills.

There are over 600 Chemistry courses available in the UK, of which 290 are single subject courses available at over 50 higher education institutions. Some are offered in combination with other STEM subjects such as Forensics or Mathematics, while others can be studied jointly with Business or Law.

Universities offering chemistry may provide the opportunity to study a three-year BSc or four-year MChem/MSci course. Courses typically require an A or B from A-level chemistry, plus other related subjects. Although A-level mathematics is not always required for entry onto a chemistry course, it is extremely beneficial to have studied it, as maths is often an important part of the degree course. GCSE Maths, English and Science at grade A* to C are also usually required.

Physics

Physicists play a vital role in many technology based industries such as optoelectronics, nanotechnology, computing and renewable energy. Others investigate the universe, apply their knowledge to healthcare (medical physics), study the processes of the Earth (geophysics) or climate (meteorology). The knowledge and skills that studying physics develops are important in other areas such as modelling complex financial systems and in law when patenting new technologies.

Almost 600 physics combined and 280 specialist courses are offered in the UK at over 45 institutions of higher education. Options include combining with other STEM subjects such as astrophysics and mathematics, whilst others allow students to combine with education or music. Students can study physics as a three-year BSc, including combinations with subjects such as nanotechnology or space science, or a four MPhys year course.

University entry requirements tend to focus on A-level achievement in physics and maths. A grade A or B is often required, along with a complementary science subject such as chemistry or biology. If you are considering engineering or architecture then you may combine physics with design-technology or art. GCSE grades A*-C are usually required in English, Maths and Science.

Engineering

Engineering uses maths and science, particularly physics, and can lead to a broad range of careers that can involve hands-on, practical work, creativity and problem solving. Studying Maths and Science at school, and having an interest in design and computing, will provide a good basis for applying to university.

Universities offer several routes to becoming a qualified engineer, that include a three-year (BEng) and four-year (MEng) engineering degree course. They may also offer Foundation degrees as an alternative and Foundation Years for students who do not quite gain the entry requirements or who studied unrelated subjects.

Entrance requirements are different for each entry route, course and university, but the four-year MEng typically requires higher UCAS tariff points than the BEng. Engineering courses will require mathematics and either a technology or science-based subject, usually physics, at both A-level and GCSE grades A*-C.

Over 2,400 engineering related courses are available at over 100 UK universities and higher education colleges. The range of courses is wide and includes, for example, general engineering degrees to those specialising in acoustics, communications, motorsport and sustainable technologies. Many courses are accredited which gives you a head start to becoming a professionally registered engineer. Further information about the routes into engineering can be found at the website: www.tomorrowsengineers.org.uk/routes

Mathematics

Mathematics' graduates are employed in a wide variety of careers including financial services, actuarial services, education, ICT and others occupations in the private and public sectors. Even if you choose a career where your mathematical knowledge is not essential, you will still find that the skills you acquire by studying maths – the ability to think rationally and to process data clearly and accurately – are very useful.

70 UK universities offer over 1,100 courses in mathematics and statistics. Most universities offer a general maths degree, which will usually include pure and applied maths and statistics in the first year. Some universities will also allow you to study mathematics with another subject such as statistics or computing.

Universities that offer three-year BSc courses may also offer four-year MMath courses that explore a wide selection of modern mathematical ideas and techniques. Typical entry requirements include obtaining an A or B grade in Mathematics and two other relevant subjects. Having an AS/A level in Further Maths would be an advantage.

The student experience

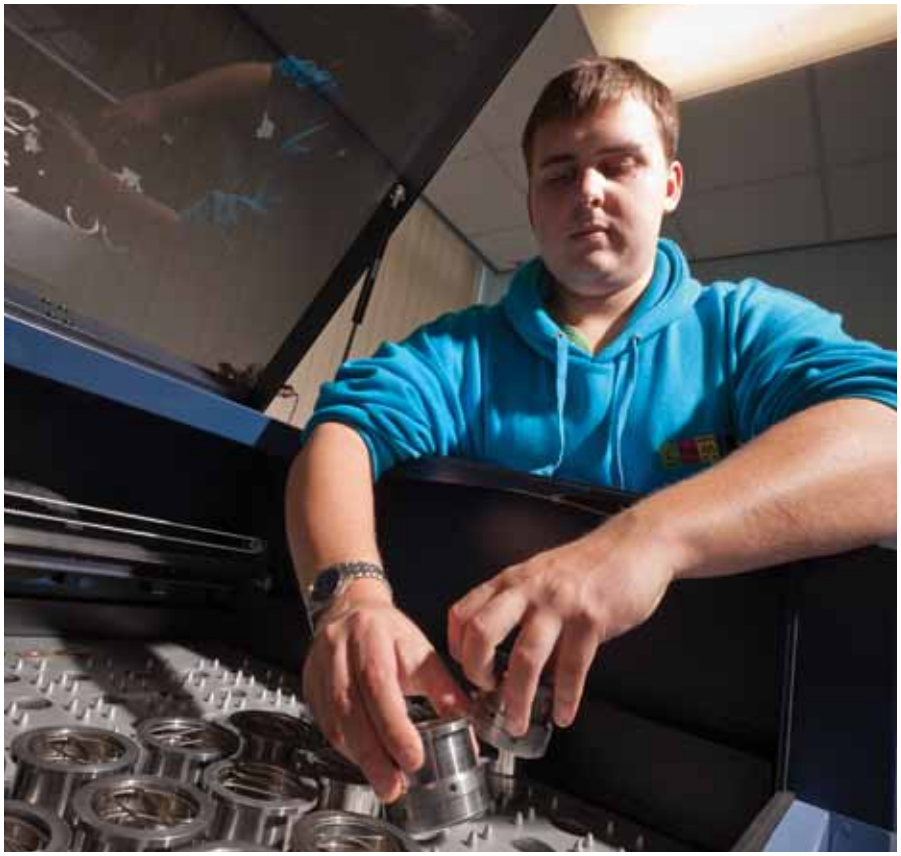
Nothing expresses the variety of STEM-based work and the rewards it offers to graduates better than the words of students themselves, as reflected in these case studies collated by STEMNET.

Sean – Chemistry

Sean studied Chemistry with Management Studies before doing a Masters degree in Analytic Sciences. He is in charge of ensuring that all the samples taken and analyses done on materials produced and discarded by the Sellafield site, conform to the strict regulations governing nuclear reprocessing and decommissioning.

'You can imagine how serious the consequences would be if we didn't do our job properly', says Sean. 'Everything that Sellafield produces, from the fuel we sell to the waste we dispose of, has to meet very strict specifications.'

He says: 'I want young people to be as interested in science as I was at their age. It's great to see the students' faces light up when they see something go bang or start fizzing as if from nothing! Science is fascinating and we need them to realise that at a young age.'



Luke –Engineering

Luke is a mechanical engineer whose career was kick-started aged 16 by a four-year apprenticeship at a niche engineering firm called Allen Gears in Pershore, Worcestershire, which makes giant industrial gear boxes for everything from oil, gas and power generation to marine propulsion in ships.

Allen Gears allowed Luke to go on to study for a four-year Masters in Mechanical Engineering. Luke now works in research and development, designing and testing gearboxes that typically measure two metres high and cost anything up to half a million pounds. Luke's latest project was designing a tidal turbine gearbox – a highly challenging and technical brief which has tested his knowledge to the full.

Liza – Engineering

Liza is a mechanical engineer in the third year of her engineering doctorate at Cranfield University. She is also co-founder and technical director of True Snowboards in Wiltshire. Liza uses her engineering skills to analyse the performance characteristics of different snowboards and develops new materials for them. She then has the fun of testing them out on the slopes at Morzine in the French Alps.

True Snowboards sponsored a team at the British Snowboarding Championships in 2008, which had a 74% medal win rate. 'I love my job', says Liza, 'because of the variety. One day I can be in the laboratory testing materials for a new board, and the next day I'll be out testing it on the slopes to see if all my work has paid off.'

John – Physics

John is a specialist engineer for the BBC where he plays a crucial role in making sure that the programme production system used by local radio stations across England is working properly. He was at university studying for a degree in Computational Physics when he first worked for the BBC during the summer vacation.

Problem solving is one of the reasons John loves his job. He relishes the challenge of identifying faults and working out how to tackle them. His work is fast-paced, time critical and never the same from one day to the next. John's next challenge is to implement new systems that will help to combine television, radio and online production as part of the digital switchover. 'One of the best parts of my job' he says 'is being able to improve the quality of service to the public, so I'm thrilled to be able to help the BBC do this.'

Laurie – Physics

Laurie is a higher research scientist at the National Physical Laboratory (NPL). She gained a BSc in Physics and Astrophysics, then went on to study for her Masters in Space Science. Laurie's main project is for the European Space Agency, looking into the use of nanomaterials in the space industry. Nanomaterials are used in everyday products to make them lightweight and strong. However, their use in the space industry is limited, and Laurie's work is breaking new ground.

She is passionate about communicating science to young people: 'I knew that I wanted to work in science when, at aged five, I used my first telescope to see the moon. Every scientist can pinpoint the moment or person who made them realise that science was what they wanted to do. Too many young people think science is a difficult and scary subject, and I'm committed to helping them see how fun and interesting it really is.'

Fayezah – Mathematics

At school, Fayezah enjoyed maths so she decided to study it (and Further Maths) at A-level. She liked the idea that there could be a right and wrong answer and that it was challenging. She also liked doing a subject with many real world applications. After doing some research, Fayezah found that there were a huge number of career options available for someone with a background in maths and so decided to continue her studies at university.

Fayezah gained a BSc Mathematics before joining KPMG, a large global accountancy firm, as a trainee actuary. 'My job involves looking at profits and losses of a company and using maths to predict its financial future using lots of calculations and graphs. My passion for maths definitely played a big part in me getting my current job.' Although Fayezah needs to make use of her mathematical skills, she also uses a lot of social skills, such as needing to explain complicated theories to a wide range of people.'

Important considerations before you decide

Now you need to give some thought to – and make decisions on – a range of crucially important topics. There are some actions you can take to improve your chances of securing your ideal university course and dream job.

Prior to Key Stage 5

While in Key Stage 4 you will need to choose which subjects and qualifications you wish to study post-16. This is an important decision, so researching widely (specifically if you have a particular course or career in mind) is crucial. If you are interested in studying a STEM subject at university then you will need to firstly look at relevant subjects such as chemistry, maths and physics. Before considering a BTEC qualification you must check with the courses and universities you may be interested in to ensure that they accept these as an alternative to A-levels.

The internet provides quick and easy access to a wealth of information, but you may find that discussing your options with other people is more useful when deciding. Talk with your family, teachers and careers advisors and, if possible, those who have studied the subject before and/or who work in the job or sector that interests you.

Many universities offer opportunities to visit them through programmes such as summer schools and taster days. If you have the chance, it is well worth considering taking part as these can give you a good insight into a particular STEM subject, a behind-the-scenes glimpse at a university and an introduction into what being a student would be like.

Work experience

Undertaking work experience before you apply to university can provide an invaluable insight into the industry you wish to join and the world of work more generally. This experience could confirm your choice of career, open your eyes to other related possibilities or steer you in a completely different direction altogether. A good placement should allow you to talk about what you've learned from the experience and demonstrate how the transferable skills will make you a better student.

Choosing a course and university

Your choice of course is, perhaps, the most important decision that you will need to make when considering continuing your studies into higher education. Once you have decided what subject you wish to study, then you will need to choose a university. There are many factors that you may wish to consider when choosing what and where you wish to study.

Entry requirements – the most important advice regarding entry requirements is to check with the individual universities that you are considering. Admissions policies vary between universities, departments, or faculties, and individual courses. If the course is accredited, or recognised, by a professional body then there may be additional requirements, perhaps a minimum UCAS tariff point amount and/or a specific subject or qualification.

It is important to be realistic when considering what you are likely to achieve with your Key Stage 5 studies and this is an area that your teachers can help you with. Universities will ask for specific subjects and grades at both A levels and GCSEs. Therefore, it is important to find out before you choose your subjects.

If you are studying qualifications other than A-Levels, such as the Advanced Diploma, BTEC National Diploma or International Baccalaureate, then seek confirmation from the university of their admissions policy regarding these.

University facilities and expertise – STEM courses generally require very specialist, and high technology facilities, and expertise that may play an important role in your decision of where to study. Buildings and equipment are important but you may also wish to consider the university's links with business, particularly if you want to study a course with a work placement year.

Location of the university – increasingly students are deciding to stay at home to study, to save money and be closer to their family and friends. Even if this is your preferred option, it is still worth considering studying further away. It could be that your ideal course is not offered locally or a university further away provides a better match in terms of your study and student life priorities. Moving away from home also gives you the opportunity to be more independent. If you do decide to move away then consider if you would prefer to be based in a city centre or further away on a self-contained campus.

Student life – the student experience is an important part of studying at university. Depending upon your own priorities you may wish to consider what the university offers in terms of: sport clubs and facilities; social clubs and societies: student union services; student accommodation and the availability of social facilities including the university's distance from the nearest city.

Course accreditation and recognition – many STEM courses will be accredited by professional organisations. It is worth considering how important this is to you and your future career. Further information can be found in the 'Want to find out more?' section.

Where to find information

Finding out information online is a good starting point and using the UCAS website course search facility can highlight alternative courses and related subject areas that you may not have considered. Universities will also have course information on their own websites. There is a list of other useful websites and online resources in the 'Want to find out more?' section on page 14.

Following this you should consider attending a UCAS or local Higher Education Fair to give you access to representatives from a wider selection of universities and colleges. When you have a shortlist of courses and universities it is well worth visiting their Open Days so that you can see the facilities and speak with the staff who will be teaching you.

Application form and personal statement

Completing the application form and personal statement may seem like a daunting experience. Fortunately there is detailed information from the Universities and Colleges Admissions Service (UCAS) on their website. Further advice and guidance may be available from your school or college's careers service and the universities themselves through their admissions or schools liaison departments, for example.

Carefully read the guidance notes that accompanying the online application form, paying specific attention to the deadline dates set by UCAS. For applications to Oxford and Cambridge, and professional medicine, dentistry and veterinary courses, the deadline is 15 October in the year before you wish to start your course. The general deadline for other applications to arrive at UCAS is 15 January. Your school or college may also have set a deadline for you to complete your application so they have time to write your reference.

When writing your personal statement bear in mind that this is your opportunity to market yourself, highlighting skills and experiences that are specifically relevant to the course and university you are applying. This is where your research will pay off, because if you have had chance to attend Open Days, speak to university staff, read prospectuses and website information then you'll have a better informed idea of what information will be relevant. You may also wish to draw on wider experiences that are not directly related to the course, such as sports and community activities and leadership roles.

Start writing your statement early so that you have time to discuss the draft with your teachers, family and, if available, the university you are considering. Remember that this may be your only opportunity to tell them why they should accept your application, and may form the basis of an interview if the university invites you to attend one.

The statement should be personal as only you know what you like, your motivations for applying and future career aspirations. If you include someone else's words then this may be picked up by UCAS's similarity detections service software .

Student finance

Students have access to a variety of financial support to help them with the costs of studying at university. Bursaries, grants and scholarships do not have to be paid back but loans do. No student will be asked to pay for their course while they are studying.

The financial support differs depending on where you live and wish to study, so please check the separate websites for England and Wales. Refer to the 'Want to find out more?' section on page 14 for the web addresses.

From September 2012 universities can charge up to £9,000 a year for their full-time courses. A tuition fee loan is available to cover the full cost of these fees. Welsh students have access to a grant and loan to cover the fees.

Eligible students may receive both a grant and loan to cover their living costs. This is often referred to as a maintenance grant (or Assembly Learning Grant for Welsh students) and maintenance loan. The amount of grant and loan an eligible student may receive depends upon where they live while studying and their family's household income (means testing). Some students may be eligible for additional support if they are leaving local authority care, have children or a disability.

In addition students may be eligible for The National Scholarship Programme (NSP) that helps students whose family income is £25,000 a year or less. Universities and colleges decide who to give financial help to and so you should check with them to find out if you qualify how to apply and what kind of funding they offer. It is also worth checking what other bursaries and scholarships individual universities offer that you may be eligible for.

Want to find out more?

There are many organisations and sources of information and advice that can help you find out more about the benefits of studying STEM subjects at university, related careers and what it's like to be a student.

STEMNET helps encourage young people to be well informed about STEM, able to engage fully in debate, and make decisions about STEM related issues. The Resources page has videos and downloadable case studies of STEM related careers.
www.stemnet.org.uk

The Royal Society of Chemistry provides information for students and parents about the options available to study and pursue a career in the chemical sciences. In particular look at the Employee Profiles for detailed information of some of the potential career options for qualified chemists.
www.rsc.org/Education/courses-and-careers

Physics provides a broad training in skills that are valued by all employers; an ability grasp concepts quickly, a determination to find coherent answers, along with problem-solving, analytical, mathematical and IT skills. Refer to the Careers page on The Institute of Physics www.iop.org website for further information.
www.myphysicscourse.org

Tomorrow's Engineers provides a one stop shop for information and resources about the amazing careers available in engineering. Try the careers route map for a brief overview of how to access the different engineering professional levels. This site is supported by the Royal Academy of Engineering www.raeng.org.uk who actively work to help create and educational system that satisfies the aspirations of young people.
www.tomorrowsengineers.org.uk

If you enjoy mathematics and are looking for related careers then try www.mathscareers.org.uk for further information and how to choose a course and university. The site includes inspiring examples of how mathematics is used in a variety of employment sectors and real life situations. In addition you wish to refer to the Institute of Mathematics www.ima.org.uk, an organisation that supports the advancement of mathematical knowledge and its applications and to enhance and promote mathematical culture in the UK and elsewhere.

Futuremorph's website is designed to show you just some of the amazing and unexpected places that studying science, technology, engineering and mathematics can take you. Refer to the 16–19+ tab for career case studies and the My Future Career feature for information on a broader range of sector specific applications of STEM.

For more detailed information about choosing your subjects post-16 you may wish to look at the Informed Choices website, www.russellgroup.ac.uk/informed-choices.aspx, created by the UK universities that form the Russell Group.
www.futuremorph.org

Prospects is the UK's leading provider of information, advice and opportunities to students and graduates. The website provides careers information, graduate profiles, information on graduate salaries and job sectors and opportunities for postgraduate study.
www.prospects.ac.uk

UCAS provides a central application, advice and information service to prospective students. This covers the process of choosing a course and university through to the online application. Details of all courses offered at UK higher education institutions are available in the course search section.
www.ucas.com

When deciding on which courses and universities to apply to you may wish to consider the following sites from two national newspapers that provide information that allows you to compare courses and universities; www.guardian.co.uk/education/universityguide and www.thetimes.co.uk/tto/public/gug

For the most up to date information on the types of financial support available for students please visit www.direct.gov.uk/studentfinance or, if you live in Wales, www.studentfinancewales.co.uk

The ERASMUS scheme encourages cooperation between European universities. One of the programmes assists higher education students with studying part of their course at a different university abroad. Please check with the university you wish to apply to that studying abroad is an option for your course.
www.britishcouncil.org/erasmus-student-programmes.htm

Trans:it is a collection of online interactive support tools to help students to recognise and develop their strengths and identified needs in preparation for learning at university.
www.transit.ac.uk

Titles in this series

- *Happy landings: a transition advice guide for students*
- *Critical moments in the first year*
- *Setting up a Maths Support Centre*
- *Improving retention: the curriculum development perspective*
- *STEMming the flow: a toolkit for improving transition*
- *Optimising the part-time experience*
- *Social engagement to promote success in retention*
- *Building on data: an evidence-based approach to improving transition, induction and retention*

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