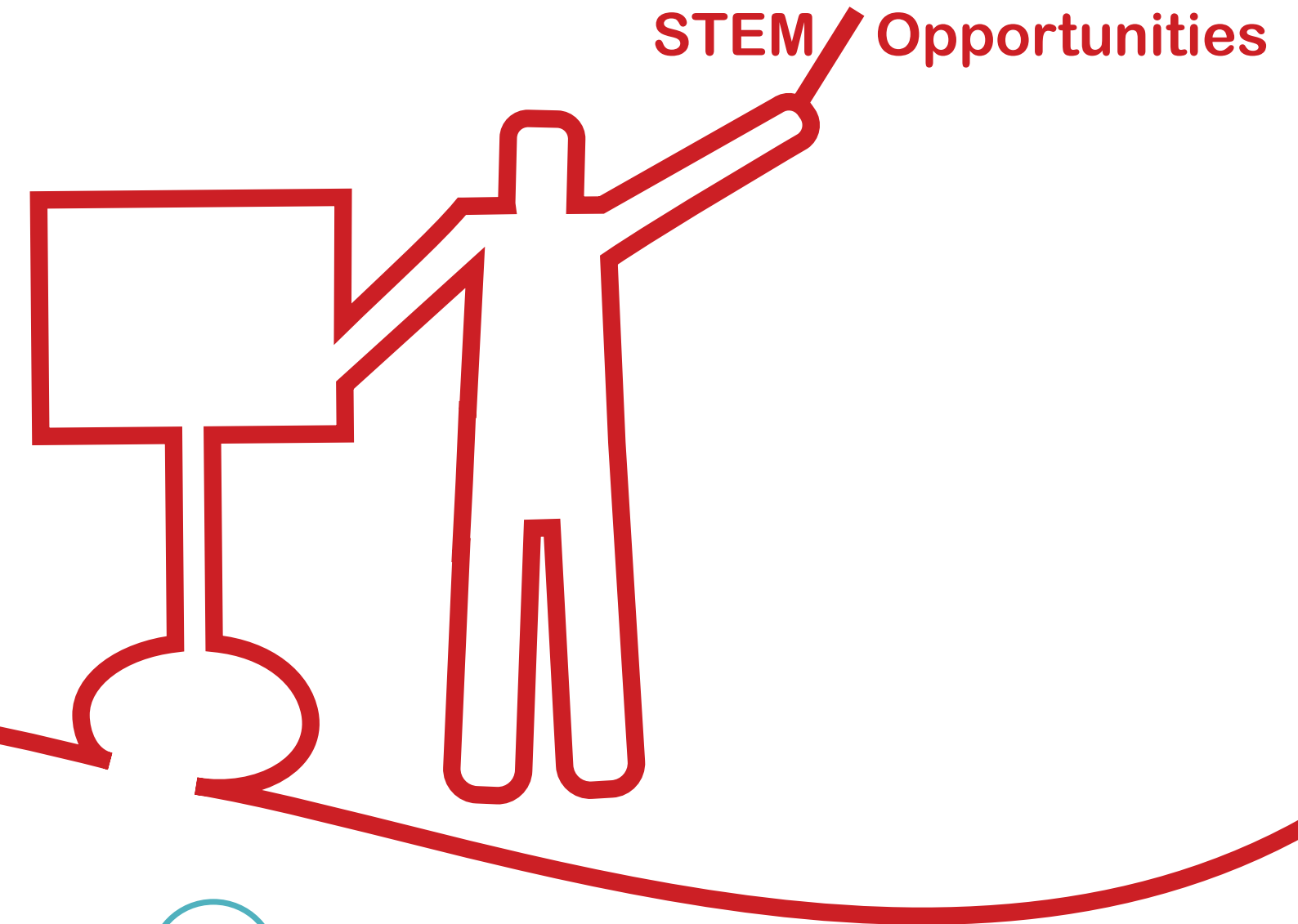


STEM Opportunities

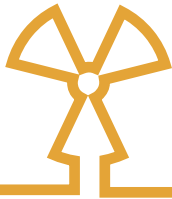


6

Making Presentations

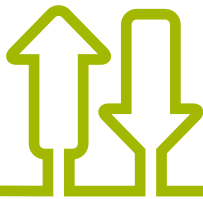
Using key facts to show the impact of STEM in dealing with today's challenges; group work ideas

Examples of emerging STEM-related opportunities – a stimulating introduction for a STEM group session that illustrates exciting developing career areas backed up with real life case studies – **YOU CAN MAKE A DIFFERENCE**



Nuclear Energy

With the commitments to build several new nuclear power stations over the next decades and the requirement to decommission numerous others, there will be a continuing demand for employees in this industry including **nuclear engineers, nuclear physicists, chemists, material scientists and mechanical engineers** ➔ [LINK TO CASE STUDY](#) Page 6.5



Renewable Energy

The UK government is planning to have 15% of the country's energy covered by renewable sources by 2020, centred on a major expansion in the number of wind turbines. Renewable energy will create jobs for **civil engineers, physicists, power engineers, electrical and electronic engineers, as well as graduates from renewable energy technology courses** ➔ [LINK TO CASE STUDY](#) Page 6.7



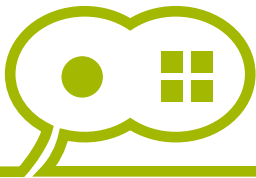
Biomedical Engineering

This developing area of medical technology involves the design and manufacture of items such as the replacement of knee and hip joints, heart by-pass valves, pacemakers, breast implants and artificial hearts. Degree courses are looking for A Levels or equivalent in subjects like **maths, physics, biology or chemistry** ➔ [LINK TO CASE STUDY](#) Page 6.9



Nanotechnology

Nanotechnology is the science of the very small. For example, carbon wire produced by nanotechnology is stronger than steel but does not melt, making electronic processes faster. Relevant subjects include **molecular chemistry, applied physics, maths, and chemical, mechanical, biological and electronic engineering** ➔ [LINK TO CASE STUDY](#) Page 6.11



Computer Games Design

The applications for computer games go beyond home entertainment to include therapeutic and medical treatments. For example, patients suffering from strokes can use video games to gain movements in their limbs affected by paralysis. A high level of **maths** is needed for this area, as well as specialist **systems engineers** ➔ [LINK TO CASE STUDY](#) Page 6.13



Space Technology

There are approximately 19,000 people working in the space technology industries in the UK, including the global telecommunications industry. Satellites are key to global positioning systems to aid navigation for shipping and road transport. The industry recruits graduates and technicians from degree subjects such as **space technology, aeronautical and aerospace engineering, avionics and electronics, physics, and maths** ➔ [LINK TO CASE STUDY](#) Page 6.15

Learning Routes and Pathways

Key facts for starting STEM group work sessions/presentations

- Apprenticeships are expanding – there is a STEM skills shortage in processing and technician roles
- Apprenticeships which include STEM skills can be found in a diverse range of sectors – visit www.apprenticeships.org.uk
- The new **Diplomas relating to STEM skills** are: Construction & the Built Environment (2008); Engineering (2008); Information & Technology (2008); Business, Administration & Finance (2009); Manufacturing & Product Design (2009); Science (2011)
- A Level subject numbers – dramatic rise in numbers of students taking psychology (e.g. 52,000 entrants in 2007) and sports science/studies over the past 20 years, compared with numbers taking physics (e.g. 27,000 entrants in 2007), chemistry, maths or biological science
- Degree subjects – the number of overall university applicants rose by 12.2% between 2002 and 2007, but STEM subject applicants rose by just 0.08%
- STEM degree subject numbers at a low base (e.g. chemistry 3,545 acceptances in 2008, mechanical engineering 4,181 acceptances in 2008) compared with more popular subjects (e.g. psychology 12,908 acceptances in 2008, sports science 7,694 acceptances in 2008)
- Studying STEM subjects keeps your options open in the STEM area, and for careers in general
- A STEM degree has added value – there is a high demand for STEM graduates in all employment sectors, with 92% of firms wanting people with these skills (CBI Skills Survey 2008)

Future Trends

Key facts for starting STEM group work sessions/presentations

- **Many of the new jobs** which will exist in the twenty-first century will be created in the STEM area
- The CBI (Confederation of British Industry) predicts that by 2014 the UK will need an extra 730,000 people with **STEM qualifications** compared to 2007
- Scientists and engineers are needed to help solve the problems created by increasing population, increasing energy demands, climate change, food production – **young people can help to make a difference** by choosing STEM subjects and careers
- Opting for a STEM route offers the opportunity to be **creatively involved** in the development of technologies such as – mobile phones, satellite navigation systems, digital technology, space technology
- The UK population is aging, with over 65s predicted to increase from 8.5 million in 2000 to 12.3 million by 2025 – this trend will increase demand on the Health Service with the **STEM skills needed by doctors, nurses, and hundreds of different types of jobs across medicine and health**
- To meet the challenge of climate change, **STEM graduates will be needed** to work on ways of reducing carbon emissions such as – carbon capture and storage, nuclear energy, solar energy, second generation biodiesel fuels
- China and India have 36% of the total world population and their economies will increasingly reflect the size of their consumer markets – **there is a great need for people with STEM skills** to continue UK technological advancements and sustain standards of living.
- Qualifications in STEM are increasingly highly valued as a platform for a wide range of careers outside STEM.

Case studies

Name: Carly Smith

Job title: Instrument Mechanic



1. Describe what your work involves.

I work as an instrument mechanic for VT Nuclear Services and am involved in the repair and maintenance of all types of radiological protection instruments on the Sellafield site, including:

- alpha/beta particulate in air monitors
- gamma alarms
- changeroom equipment, eg: hand monitors, IPMs and frisk probes – an IPM is an Installed Personnel Monitor; it monitors the whole body, including hands, feet and head as you are leaving a trace radioactive area
- criticality incident detection and alarm systems (CIDAS)
- portable pressure instruments
- 2000/6000 series electronic cards – these are nuclear data acquisition cards and there are many types.

Some remedial work is completed on site, but when this is not possible, the repair work is done in the workshop, where repairs are carried out on electronic circuit boards down to component level. I work in both areas.

2. Why did you choose this type of work?

Living in West Cumbria, which is renowned for its strong links with the nuclear industry, I have always thought the Sellafield site would be an interesting place to work. I had thought about a career in the industry, but wasn't sure about how to get a 'foot in the door'. Whilst studying for my A Levels, I became aware of an Apprenticeship programme where you go through college and receive a recognised qualification in your field, but you also learn on the job. I thought this would be invaluable training. Instrument mechanics at Sellafield are in demand so I thought it would be good to develop skills in this area as there will always be the opportunity to work and make a good career.

3. How did you get started?

I applied to a local training provider called Gen II to start an Apprenticeship. I had to pass an aptitude test and interview process to get on to the NVQ Level 2 in Electrical and Instrument Engineering. Once I completed the first year of the Apprenticeship, I was interviewed by the Central Instrument Services (CIS) manager at Sellafield and was then taken on as an apprentice by VT Nuclear Services. After two-and-a-half years I completed an NVQ Level 3 in Instrumentation and the full Apprenticeship. I have now been a full instrument mechanic for two years and I am currently in the second year of study for a Degree in Electrical/Electronic Engineering.

4. What is the importance of maths or science in your work?

Both these subjects are of great importance in my work; the science to get an understanding of the basics of nucleonics and how the instruments work, and the maths to work out electrical/electronic equations, also for everyday tasks such as working out efficiencies.

5. What subjects did you study at school?

I studied the required subjects of maths, English and science, however the choices I took do not reflect the job I do now. These were PE, English language and home economics. I did these subjects at both GCSE and A Level.

6. What qualifications do you need for your job?

You need good GCSEs, especially in maths and science, as these help give a good understanding of the job.

7. What could you earn?

It depends on how far I want to go in my career. At the moment I earn a good salary and this is at instrument mechanic level. It can go up dramatically depending on which path I follow, maybe up to £50,000 a year.

8. What excites you most about your work?

I think one of the most exciting things is the fact that the Sellafield site relies on us to maintain the smooth operations of the plant. If we are not reliable in our job and do not provide the services we are meant to, it has a direct impact on the work force who are obviously unable to go into the active area and carry out their duties. This is a great motivation for getting the job done as efficiently as possible for our customers.

9. What tips could you give to someone who wants to enter this type of work?

I think anyone who wants to enter this field of work should definitely consider looking into an Apprenticeship scheme. Not only do you get the hands-on work, but you also get college training and work towards a qualification such as an ONC or HNC in Electrical, Electronic or Instrumentation Engineering. There is also the possibility to take this further, such as to degree level. If you have ambition, drive and a strong work ethic, then you won't go far wrong in this industry.

10. How do you see the future for your area of work?

The future for engineering in the nuclear industry is bright. It looks like there will be further growth not just in West Cumbria but in other parts of the country as well, as the government has given the nuclear industry the green light for future development. This industry has a strong economic future. This is great news for my area of work because there will always be a need for the services we provide.

Case studies

Name: Catherine Loynd

Job title: Sales Support Engineer



1. Describe what your work involves.

REpower Systems manufactures, installs and services wind turbines. REpower UK is responsible for selling REpower wind turbines within the UK, then project managing the installation of them and providing maintenance services.

I work within the sales department, offering technical support during the sales phase. A large part of my role involves analysing the wind conditions at potential sites. When one of our clients designs a new wind farm site they will install measuring equipment on the site that will measure the wind speed, direction and other parameters over a period of time. This enables our clients to calculate, amongst other things, the energy production that they can expect from the site. This in turn allows them to estimate how much money they will make from the site. I also analyse this data to check that our machines will be suitable for the site and advise clients which of our range of turbines would be best for their site. For example, we have different turbines designed to operate at different average wind speeds. For me, this work involves visiting the site, using computer packages to analyse the data and writing reports.

Other aspects of my role include supporting the sales managers during technical contract discussions and negotiations, and answering technical queries from clients and interested parties. This involves a lot of contact with people, both face to face and via phone/email.

2. Why did you choose this type of work?

I went to the University of Nottingham and studied a Masters Degree in Mechanical Engineering. At university I researched the career opportunities for engineers, and, although I knew I wanted to work in engineering, I graduated without a clear idea of the sector I wanted to work in.

Having gone straight from school to university, I decided to take some time out. I spent a summer surfing in Europe and a winter snowboarding and working in Canada. It was partly during this time that I made the decision to work in the renewable energy sector. I have always enjoyed outdoor activities and the thought that my work would be helping to protect the environment was very motivating.

3. How did you get started?

Having made this decision, I started looking for jobs in the renewables sector. My first job was with Proven Energy (a manufacturer of small wind turbines) and the University of Strathclyde. My role was that of research and development engineer. My work concentrated on the design of the wind turbine blades and research into new materials and methods of manufacture. During my time in this role, I registered for a research degree with Strathclyde and gained an MPhil in Mechanical Engineering. Whilst I enjoyed the work at Proven, when looking for my next job I decided that I would like a role with more interaction with customers or suppliers; a role that would still be technical (although maybe less so) but that would allow me to get out and about a bit more. And that is what I found with my role at REpower.

4. What is the importance of maths or science in your work?

Maths and science have played a very important role in both of my jobs so far. My first role was very technical and involved lots of calculations and practical experiments and research. Even though my current role is less technical, the wind analysis work involves some quite detailed calculations and I have to be able to understand various technical ideas and concepts. It is also important that I understand the operation of the turbines in order that I can explain this to clients or other relevant parties and this requires an understanding of the engineering (including maths AND science) behind them.

5. What subjects did you study at school?

Amongst others, I studied GCSEs in maths, science and technology. At A Level I studied maths, physics, chemistry and Spanish.

6. What qualifications do you need for your job?

You need a degree in engineering or other science/technology subject or equivalent relevant experience in the field of engineering.

7. What excites you most about your work?

I am still excited and motivated by the fact that the work I do has a direct benefit for the environment and the world we live in. However, I have come to realise that the renewables sector offers much more than that. The sector is growing rapidly and will continue to do so as the requirement for installation of renewables continues to increase. Because of this the whole sector is a very exciting place to work and is attracting highly skilled people from other sectors as well.

8. What tips could you give to someone who wants to enter this type of work?

Whilst the renewable energy sector is growing and there are many jobs available, competition is still high. Relevant work experience in an engineering field is invaluable for new graduates and this could be through a sandwich course, summer placement or part-time job. A keen interest in renewable energy and the environment is also beneficial. It can help you stand out from the crowd if you can demonstrate that you have developed other skills, for example the ability to work in teams or good communication, through activities outside of work and study, such as music or sport.

9. How do you see the future for your area of work?

The future of the renewable energy industry is very exciting. The sector will continue to grow by building and improving on existing technologies, such as wind turbines, and establishing and developing new technologies, such as wave and tidal power. A career in the industry will provide an exciting and challenging place to work for the foreseeable future.

Looking to the future I still see a wide variety of options ahead for me. Within REpower, if I wanted to move on, I could perhaps work in one of our international subsidiaries or work in a different role. Most of our sales and project managers are engineering or science graduates. Engineering is still offering me a challenging role and wide variety of future opportunities.

Case studies

Name: Richard Boyle

Job title: Biomedical Engineer



1. Describe what your work involves.

My current work at the University of Strathclyde is the development of an electronic stethoscope system that will allow doctors to hear heart problems more easily. This involves working with electronic circuits and software with the Department of Electronic and Electrical Engineering, and also biological aspects through the Department of Bioengineering. As part of my work I liaise with doctors and representatives from medical device companies. I am also hoping to start up a small business selling stethoscope systems to doctors thanks to funding from Scottish Enterprise through the Royal Society of Edinburgh. So the work is extremely varied and very rewarding.

2. Why did you choose this type of work?

I have always been interested in electronic devices and how they work, and I enjoy applying electronics in order to solve problems and do useful things. I am hoping that I will be able to develop devices and products that will help to improve people's lives.

3. How did you get started?

After school, I did a Masters Degree in Electronic and Electrical Engineering at the University of Strathclyde. I also completed some business classes during my degree course, which initially got me thinking about starting up my own business. I then went on to study an Engineering Doctorate in Medical Devices through which I started the electronic stethoscope project and also had more classes on business-related aspects. I have always been fascinated by biology, and studied classes involving physiology and anatomy which were really interesting and very useful for the work I currently do.

4. What is the importance of maths or science in your work?

Maths and science are extremely important in my work as I use many mathematical techniques in order to analyse the heart sound signals. These techniques are used to reduce the amount of noise that is heard within the heart sounds themselves, and also to enhance the abnormal sounds in order to provide the user with an improved diagnosis of any heart problems.

5. What subjects did you study at school?

I completed six Scottish Highers including physics, maths and English and two A Levels in physics and maths, which were essential in allowing me to get an offer of a place on the degree course.

6. What qualifications do you need for your job?

You need a Masters Degree in Electronic or Electrical Engineering or equivalent.

7. What could you earn?

Potentially I could earn two to three times the average wage.

8. What excites you most about your work?

I am excited by the opportunity to work on exciting, technical projects that could potentially help doctors to diagnose heart problems more effectively and help people live longer and enjoy healthier lives.

9. What tips could you give to someone who wants to enter this type of work?

I would suggest studying hard and selecting maths and physics as well as choosing other subjects that you are really interested in and passionate about.

10. How do you see the future for your area of work?

Unfortunately heart disease is still a huge problem, especially in this country, so there are lots of opportunities in this area of work and any technical developments would be extremely useful.

Case studies

Name: Andrew Rees

Job title: Research Engineer in Micro/Nano Engineering



1. Describe what your work involves.

I work as a research engineer in the field of micro/nano engineering at Cardiff University. Basically, my job requires me to develop processes that can be used to produce components that are below 1mm in size. This can include parts for things such as medical devices, mobile phones, micro gears, printers and digital cameras.

2. Why did you choose this type of work?

I wanted to be involved in state of the art research and development. Working in the field that I do, allows me to work daily on some of the most sophisticated and complex machinery available in the world. Also some of the research that I get involved in combines skills from many different disciplines such as physics, chemistry and computer science. The combination of different disciplines ensures that I'm learning new skills constantly.

3. How did you get started?

I left school at 16 to do an Apprenticeship as a toolmaker for four years. My Apprenticeship allowed me to gain a strong set of practical skills, but it was always my aim to do an engineering degree. During my Apprenticeship I wanted to support the practical skills with some theory and so I studied on a day-release basis to gain an ONC, HNC and HND. Following my Apprenticeship I continued studying and did a degree on a part-time day release basis whilst working as a toolmaker. I gained a Degree in Mechanical and Manufacturing Engineering. Once I completed my degree I found myself in the fairly unique position of having a very strong theoretical background to complement my practical skills. Usually to work in a university you need a PhD, however, because of the unique skill set that I have I was employed without one. However, this was only on the basis that I enrolled on a part-time PhD programme. I am on the verge of completing my PhD in Micro-Electrical Discharge Engineering.

4. What is the importance of maths or science in your work?

To work in engineering research and development, a strong knowledge and understanding of maths and science is essential. You need to understand the physical, biological or chemical behaviour of processes to develop components.

5. What subjects did you study at school?

I studied GCSEs in physics, chemistry, biology, maths, and design and technology, among others.

6. What qualifications do you need for your job?

To do research work at university you usually need a PhD. However, in industry a good degree in physics or an engineering discipline is usually sufficient.

7. What could you earn?

In my present role my salary can reach £44,000 a year.

8. What excites you most about your work?

I think that the work that I'm involved in is helping to develop the way we live. It can include developing components that make our mobile phones do smarter functions or take better photos. One project that I was involved in looked at trying to help a patient with a spinal injury regain the use of their limbs. The area of micro/nano engineering can be used in such a variety of applications that it's become a very interesting field to work in, and one which is constantly developing.

9. What tips could you give to someone who wants to enter this type of work?

The field of engineering research and development can be difficult to break into. However, the job offers many rewards both financially and through job satisfaction. Work hard during your education and this will ensure that a variety of career paths will be open to you.

10. How do you see the future for your area of work?

The area of micro/nano engineering is growing in profile as its application is so varied. Hopefully, due to increasing demanding consumer requirements and government funding this hot research area is going to expand rapidly and keep pushing the boundaries of product and process minimisation.

Case studies

Name: Chris Davis

Job title: Senior Designer



1. Describe what your work involves.

As a senior designer at UK Haptics I work with advanced 3D visual effects and animation software, building 3D models of limbs, bones, muscles, organs, medical instruments, etc. I also create photo-real animations and stills for promotional material. The virtual reality software that we develop is used to help train medical students and nurses in 3D virtual environments.

2. Why did you choose this type of work?

I have been interested in visual effects and computer animation for a long time now, and this way I get to work with some amazing technology and high-end software, where the only real limit in what can be created is your imagination. Working in this specific field is also rewarding in the fact that you're working with a product that has the potential to improve the lives of so many people.

3. How did you get started?

I did a placement with UK Haptics after completing my degree, and before starting my Masters degree at Teesside University. I found the placement through a company that specialises in getting students and recent graduates into the digital industry.

4. What is the importance of maths or science in your work?

Essential. I don't personally have to use maths at an advanced level, being more of an artist/designer, but the software I use has been built by some of the brightest mathematicians and scientists around. The software gives me the tools to create pretty much anything I require, from fluid dynamics, to physics simulations and photo-realistic lighting and surfaces.

Having a good grasp of maths and science is very useful in the industry I work in, but more importantly, if it wasn't for the scientists and mathematicians creating these tools and hardware, the films, games and digital technology that we have today couldn't exist. So the two disciplines work hand in hand really.

5. What subjects did you study at school?

I studied GCSEs including science, maths and English, plus art and design, and went on to study art, design and communications, and computing at A Level.

6. What qualifications do you need for your job?

I did a Degree in Creative Visualisation at Teesside University, followed by a Masters Degree in Creative Multimedia, but there is a greater range of courses around now than when I went to university. Ideally you would have a degree in a field like computer animation or visual effects, or a training course specialising in the digital effects and animation industry.

7. What could you earn?

I think that depends on the company you work for and how far you progress with your skills. Most games companies tend to be fairly huge, so it's a little harder to move up the ranks, but you can earn a substantial salary if you really progress in your field of work. I often spend chunks of my own time trying out new ideas or learning new things. If your employer sees the effort you put in and your passion, your salary will reflect that.

8. What excites you most about your work?

One of the main things for me is the total creative freedom I have with the tools I use. However, I also have to be very accurate with the models that are made, as they are to be used in medical simulations. I work on some projects where I can really use my imagination, and use all the amazing technology we have here to build and bring to life my own creations. Working with human anatomy is also fascinating for me – the human body is such an amazing organism, and you really get a deeper understanding of how it works when building all the muscles and organs in 3D.

9. What tips could you give to someone who wants to enter this type of work?

Start now! A lot of people think you have to wait until university or college to start learning the necessary software and tools they need, but most home computers can run the software now, and there are personal learning editions to most of the tools you need. A good grounding in all areas of cinematography and art is also useful, as is some knowledge of cameras, lighting and the way light and colour work. Joining a forum is also a good idea.

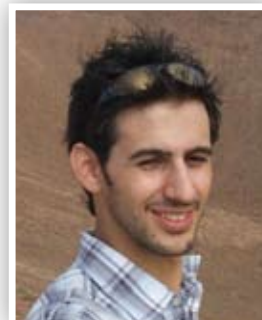
10. How do you see the future for your area of work?

I think the process of turning ideas into reality will speed up dramatically as the power of hardware and tools increases. Real-time technologies will be implemented more, meaning less time having to wait for renders or animations to process, and more time to actually create and animate. 3D is also starting to take off. Television, games and films will increasingly be viewed in stereo 3D. I can see touch screen technology and Haptic devices becoming part of home computers. With the success and ease of use of devices such as the iPhone and Wacom tablets I think drawing and creating directly on the screen will become the norm.

Case studies

Name: Chris Antoniou

Job title: Mechanical Design Engineer



1. Describe what your work involves.

I am a graduate engineer in my dream job. You'll find some of my best work up in space. Working at Surrey Satellite Technology Ltd (SSTL), world leaders in the design and manufacture of small satellites, I am a member of the team responsible for the design, manufacture and testing of spacecraft structures.

These structures must withstand harsh G-forces encountered during launch, and continuous hot-to-cold temperature variations during their orbit around the Earth. Therefore, all the spacecraft we design go through a rigorous testing regime, initially simulated with computer software, and then onto real-world testing. I am also involved in the design of subsystems, such as solar panels, control mechanisms and sensors.

Most of my work is carried out using CAD software, but you may also find me in the assembly room constructing an SSTL spacecraft, or in our specialist vibration testing facilities, shaking a structure to pieces – or rather trying to!

2. Why did you choose this type of work?

I have been interested in mechanics and solving mechanical problems from an early age, initially building, designing and racing radio-controlled cars and planes. Today my hobbyhorse is bicycle and motorbike mechanics, so it makes sense that my dream job takes my mechanical problem-solving skills to a new level.

Problem solving for me at SSTL means designing and building spacecraft equipped for the environment of space, ensuring lifetimes that cover the job they are there to do, within customers' budgets. As a design engineer, I am involved in all aspects of the spacecraft lifecycle – from designing the initial structure, through to manufacture, assembly and eventually testing my own solutions – once nothing more than an idea or a sketch in a notebook.

3. How did you get started?

I helped a friend to design a spacecraft at university and realised just how interesting the space industry was. So when an opportunity to work for SSTL came up, I took it.

4. What is the importance of maths or science in your work?

Most of my work is based on a fundamental understanding of maths and materials science. Materials science is used to understand why our satellites may fail during launch or up in space. For example, the structural material may weaken from the continuous expansion and contraction caused by the temperature fluctuations in a space environment.

5. What subjects did you study at school?

Among others, for GCSE I did maths, physics, chemistry and biology and for A Level I did maths and statistics, physics, and design and technology.

6. What qualifications do you need for your job?

I have a Degree in Mechanical Engineering. Generally to enter this field you need a good degree in a relevant subject, such as mechanical or aerospace engineering.

7. What excites you most about your work?

What most excites me is having the opportunity to work on complex designs which will be shot off into space.

8. What tips could you give to someone who wants to enter this type of work?

My advice to anyone wishing to enter this field, beyond obtaining a good university degree, is also to prove your passion for the subject to help you stand out from the crowd. For example, enter competitions or develop mechanics-type hobbies. If you can't find such opportunities, then make your own. Build or design something – that's what I did. You will be rewarded for your efforts with a good starting salary, increasing quickly as you gain more experience and skills.

9. How do you see the future for your area of work?

The future for the satellite business is good. It can only continue to grow as we continue to explore and exploit space further. New applications for our small satellites are cropping up all the time – satellite navigation and monitoring systems for agriculture, natural disasters, traffic and pollution. We also send science experiments into space, so that will be a continuing source of interest.

ACTIVITY 1

STEM day

An introductory, awareness raising activity to highlight the range and diversity of STEM jobs and their impact on our daily lives.

Summary

Students consider the range of STEM jobs that have affected and continue to affect the way they live.

Materials

Resources as provided or indicated on resources pages – *diary page worksheets, jobs list, large sheets of card or flipchart paper (enough for one per small group), flipchart pens.*

Careers information directories and/or access to computers

Preparation

Print or photocopy and cut out the various cards and worksheets to be used.

Steps

1. Class work in small groups

Explain that they are going to think about their daily life, what they do, where they live, where they go etc. and consider where and how STEM jobs or subjects have been involved. Some activities will be obvious, listening to their iPod, using their computers, doctor's appointment, for example. Encourage them to consider less obvious activities. Suggest that they start at the beginning of a day and work through. Talk them through some examples:

Getting out of bed

- the bed and bedding – for example textile development and testing, the mattress will have been designed and tested for maximum support and durability

Washing and dressing

- running water, hot water, soap – engineering, research scientists, plumbing
- clothes – textile development, machine design and development...

Eating breakfast

- Cereal – product development, soil analysis, environmentalists, food processing...

Give each group a diary page worksheet and allocate different days or parts of a day and weekends for them to work through, e.g. weekday school morning, weekday school afternoon and evening, Saturday, Sunday, weekday in the school holidays. Ask them to discuss their day and complete the 'diary' together.

Some of the following suggestions may help if they appear to be stuck:

- playing football (or any other sport)
- watching TV
- shopping
- disco
- paper round (or other part-time job)
- lessons
- hairdressers...

2. Once groups have several ideas listed, take feedback and continue discussion

- Ask each group to explain one of the activities they have identified and its possible STEM links.
- Have they been surprised by any of their 'findings'? If so, in what way?
- Discuss with them what subjects they think would be needed, or help for the areas of work identified so far.
- Encourage them to work towards the conclusion that STEM subjects can lead to a wide range of jobs.

3. Ask students, in their groups, to consider their favourite activity, e.g. computer games, eating chocolate. Tell them to discuss and select one activity/item for their group.

- Give each group a large sheet of card or flipchart paper and some pens. Explain that this time they are going to identify specific job titles connected to their choice and produce a poster to illustrate this.
- Give them the list of jobs and ask them to write on their flipchart those that they think would or could be involved.
- Be prepared to answer questions about what some of the jobs are or have a selection of resources to hand out for students to use.
- If computers are available to them they could research jobs and use them to produce their posters. Set an appropriate time limit.
- If they can access the website www.futuremorph.org it provides interesting information for them.
- Once posters are complete ask each group in turn to display their poster and talk through what they have included and why. Other groups can contribute other suggestions.
- It may be possible to display the posters in a careers/Connexions resource centre.

ACTIVITY 2

STEM speed dating

An introductory, awareness raising activity to highlight the diversity and importance of STEM, associated careers and the speed of developments in the field.

Summary

Students use cards to consider timings of a selection of events, discoveries and developments and place them in the appropriate decade on a timeline.

Materials

Resources as provided or indicated on the resources pages 6.24 – STEM cards, decade cards, 'local/us' cards, blank cards

- reusable adhesive, large flipchart sheet or paper.

Preparation

- Print or photocopy and cut out the various cards to be used. It may be useful to use card or laminate them if planning to use this activity more than once.
- Prepare the flipchart paper as indicated on the resources pages.
- Place/stick the 'decade' cards along a wall, leaving enough room for a group of students to stand by each one, and put some reusable adhesive next to each card.
- Place the flipchart/large paper in the front of the room.

Steps

1. Give each student one of the 'local/us' cards

- Ask them to read it and think about the decade in which it happened. (Depending on the numbers in the session, groups of four/five students should have identical cards.) Explain that the decades chosen cover the lifetime of people they may know or know about.
- For those with the 'I started secondary school' it will be easy. Some help may be needed for students having cards with other generations of family on. Explain that they don't need to be exact and personal information isn't needed – just an idea of the likely decade.
- Ask students to take their cards and stand next to the decade they think is appropriate.
- Briefly discuss what they have placed in each decade. Explain that the purpose of this is to give them an awareness of the time/timing for the timeline they are going to work towards.
- Tell them to move to the flipchart and, using some reusable adhesive, stick their cards in the appropriate place in the top row.

2. Class work in small groups (the groups could be those that formed around each decade)

- Give each group the set of cards for one area (health, education etc.) Explain that these are just a selection of events/discoveries from the decades they have considered earlier.
- Ask the groups to discuss and decide which they think is the correct decade for each of their cards.
- When they have agreed they stick their cards on the flipchart in what they consider is the appropriate decade.
- When all cards are on the flipchart ensure that all students can see it and begin to talk them through the answers and discuss/question which one(s) are correct and which ones they think need moving. Each group, in turn, could indicate which they think happened first in their area.
- Question them as to what surprised them and why. Remind them that this is only a selection of developments during this period.
- If they have not previously been aware of STEM ask them what all the cards have in common.
- The answer – STEM (science, technology, engineering, maths). All the developments relate in some way to these subjects.

Continue the discussion to include:

- What they think have been the most important developments.
- Has the speed of development been faster or slower than they would expect?

3. Back in their groups ask them to look at the timeline they have produced and think about what developments they would like to see in future decades

- Give them blank cards and ask each group to write one development they would like to see with an estimated date. They place these cards at the far right hand end of the flipchart.

4. Discuss with them what careers/jobs they think would be needed to achieve the developments they have suggested

- What subjects/courses would help?
- List these on paper for future sessions.

ACTIVITY 3

STEM speed dating (alternative)

An introductory, awareness raising activity to highlight the diversity and importance of STEM, associated careers and the speed of developments in the field.

Summary

- Students use cards to consider timings of a selection of events, discoveries and developments and place them in the appropriate decade on a timeline.
- A 'Bingo' style game is used to help identify decades.

Materials

- Resources as provided or indicated on resources pages
- STEM cards (you will need to have six from each decade covering each of the areas, health, entertainment etc)
- Decade cards – one for each group
- 'Local/us' cards, World/International cards, blank cards
- Reusable adhesive, large flipchart sheet or paper.

Preparation

- Print or photocopy and cut out the various cards to be used.
- A selection of STEM cards for each area is given for you to select from as appropriate. The Decade cards have only six boxes to be filled as the game and discussion can take a long time to complete with more.
- It may be useful to use card or laminate them if planning to use this activity more than once.
- Prepare the flipchart paper as indicated on the resources pages.
- Place the flipchart/large paper in the front of the room.

Steps

1. Give each student one of the 'local/us' cards

- Ask them to read it and think about the decade in which it happened. (Depending on the numbers in the session groups of four/five students should have identical cards.) Explain that the decades chosen cover the lifetime of people they may know or know about.
- For those with the 'I started secondary school' it will be easy. Some help may be needed for students having cards with other generations of family on. Explain that they don't need to be exact and personal information isn't needed – just an idea of the likely decade.
- Discuss with students what they think are the appropriate decades. When agreement has been reached tell them to move to the flipchart and, using some reusable adhesive, stick their cards in the appropriate place in the top row.

Explain that the purpose of this is to give them an awareness of the time/timing for the timeline they are going to work towards.

Place the World/International cards on the bottom row to give them an idea of some world events before moving on to using the STEM cards.

2. With class working in six small groups, give each group a Decade card to use as a 'Bingo' card.

- Explain that you are going to read out a selection of events/discoveries from the decades they have considered earlier. They will need to decide whether or not it belongs to their decade.
- Read out a STEM card and ask which group wants to 'claim' it.

You can adjust the rules/method of play depending on your group, for example:

- Give the card to the first group to call out, irrespective of whether or not it is correct, and as the game goes on and students realise some answers are incorrect they can negotiate with others and discuss why they thought what they did.
- Only give the card to the group with the correct decade if they claim it and save unclaimed and incorrectly claimed cards for negotiating at the end.
- For a visual timeline once all the decade cards are completed and correct students can place their STEM cards on the flipchart/paper in what they think is the appropriate area (health, entertainment, etc.) Some discussion may be needed at this point and an acknowledgement that some cards can be allocated to more than one area.

3. When all cards are on the flipchart ensure that all students can see it and question them as to what surprised them and why.

- Remind them that this is only a selection of developments during this period.
- If they have not previously been aware of STEM ask them what all the cards have in common.
- The answer – STEM (science, technology, engineering, maths). All the developments relate in some way to these subjects.

Continue the discussion to include:

- What they think have been the most important developments
- Has the speed of development been faster or slower than they would expect?
- What they think motivates development...etc

4. Back in their groups ask them to look at the timeline on the flipchart and think about what developments they would like to see in future decades.

- Give them blank cards and ask each group to write one development they would like to see with an estimated time. They place these cards at the far right hand end of the flipchart.

5. Discuss with them what careers/jobs/ they think would be needed to achieve the developments they have suggested.

- What subjects/courses would help?
- List these on paper for future sessions.

Resources

Large flipchart sheet or paper prepared as follows

	50s	60s	70s	80s	90s	00s	Future
local/us							
health							
nature, environment							
education, IT, communication							
entertainment, culture							
industry, business							
international							



50s

60s



70s

80s



90s

00s

'Local/us' cards

6.28

You will need 5/6 of each of these to enable students to form groups.
You may want to change/add others as appropriate for your students.



I started secondary school

My parents' generation started secondary school

My grandparents' generation started secondary school

I started secondary school

My parents' generation started secondary school

My grandparents' generation started secondary school

I started secondary school

My parents' generation started secondary school

My grandparents' generation started secondary school

I started secondary school

My parents' generation started secondary school

My grandparents' generation started secondary school

I started secondary school

My parents' generation started secondary school

My grandparents' generation started secondary school

I started secondary school

My parents' generation started secondary school

My grandparents' generation started secondary school

'Local/us' cards

6.29

You will need 5/6 of each of these to enable students to form groups.
You may want to change/add others as appropriate for your students.



Hollyoaks started

First Harry Potter
book

Elizabeth II became
Queen

Hollyoaks started

First Harry Potter
book

Elizabeth II became
Queen

Hollyoaks started

First Harry Potter
book

Elizabeth II became
Queen

Hollyoaks started

First Harry Potter
book

Elizabeth II became
Queen

Hollyoaks started

First Harry Potter
book

Elizabeth II became
Queen

Hollyoaks started

First Harry Potter
book

Elizabeth II became
Queen

'Local/us' cards

6.30

You will need 5/6 of each of these to enable students to form groups.
You may want to change/add others as appropriate for your students.



First Doctor Who
programme televised

Our school was built

Diana, Princess of
Wales, died

First Doctor Who
programme televised

Our school was built

Diana, Princess of
Wales, died

First Doctor Who
programme televised

Our school was built

Diana, Princess of
Wales, died

First Doctor Who
programme televised

Our school was built

Diana, Princess of
Wales, died

First Doctor Who
programme televised

Our school was built

Diana, Princess of
Wales, died

First Doctor Who
programme televised

Our school was built

Diana, Princess of
Wales, died



Health	Nature/Environment	Education/IT/Communication
Rosalind Franklin discovers the helical shape of RNA/DNA nucleic acids	The idea of solar wind is put forward by Eugene Parker	Texas instruments devise and market the first hand held calculator
Lasers first used in surgery	Apollo 8 is first manned spacecraft to orbit the Moon	First email message sent
First female contraceptive pill is developed	Helen Sharman becomes the first Briton in Space	Release by IBM of first personal computer complete with Microsoft operating system
Materials scientists develop synthetic skin	First world climate conference	Silicon chips used for the first time in computer memory applications
Invention of disposable contact lenses	Nuclear power becomes the primary energy source in Arco Idaho in the US	Tim Berners-Lee invents the World Wide Web
Fibre optic endoscope is tested on human patient	Satellite observation of Hurricane Andrew enabled thousands of people to evacuate threatened Florida areas	First transatlantic telephone cables
Polymer water implants used to treat brain cancer	General Motors introduces the catalytic converter	First portable cell phone call made
First oral polio vaccine developed	TIROS-1 is the first meteorological satellite to be launched	First use of the computer mouse to demonstrate how text files could be clipped, copied and pasted
Three blind patients receive the world's first bionic eyes comprising 3,500 microscopic solar cells which act to convert light into electrical impulses	Revelle and Keeling announce potential problem of greenhouse gas emissions and begin a study of the levels of carbon dioxide in the atmosphere	Formation of Microsoft computer software company by Bill Gates and Paul Allen
Human genome project finishes with complete mapping of human DNA sequences	World's first commercial wave power station opens in Scotland	CD-ROM devices introduced into computers



Entertainment/Culture	Industry/Business/Finance	International
First video game invented by Ralph Bauer	Bar codes scanned using lasers are placed on shopping products for the first time	England's pupils placed in top 10 for science and maths in global league table
Colour television pictures are first transmitted	First non-stick pans developed using Teflon	Modern high explosives developed for the first time
Fuji develop and market the first disposable camera for photography	Launch of first small scale photocopying machine	Minister announces more 'flash and bang' needed to enthuse pupils in school science as a 21% drop in positive attitudes is recorded
Kodak launched the instant colour camera	Volkswagen began testing photovoltaic arrays mounted on roofs of vehicles to tap solar energy	Kyoto Protocol on reduction of carbon dioxide emissions agreed
First digital TV channels available in the UK	General Motors introduces the catalytic converter	Control of Pollution Act passed in the UK, exerting tighter controls on industrial pollution
ITV launched in the UK	Synchrotron light source becomes operational producing X-rays for structural analysis	UN Conference on Solar Energy in the Developing World
Apple's iPhone goes on sale with features including touch screen, media player, wi-fi, camera and web-browser	Development of Scotchguard fabric and material protector by Patsy Sherman	Research suggests supply of large fish in the seas has diminished by 90% since 1950
Stereo FM radio broadcast for the first time	To improve vehicle safety, Pontiac develops bumpers that partially absorb the energy of a collision	Friends of the Earth formed
Invention of synthetic alternative to grass – AstroTurf. Introduced into American sports stadia and patented	Concorde the first commercial supersonic aircraft is launched to the public	Devastating tsunami generated by an earthquake of magnitude 9.0 claims 300,000 lives across Indonesia, Thailand and India
First Digital Versatile Disc (DVD) players launched in Japan	Kurt Ziegler and Giulio Natta awarded Nobel Prize for their work on the chemistry of high polymers	Alliance of Small Island States demand a 20% reduction in global emissions by 2005 fearing they might disappear under rising sea-levels
First computer game devised Spacewar	Launch of two biodegradable plastics	World population surpasses 6 billion

STEM cards with answers

6.33



Health	Nature/Environment	Education/IT/Communication
Rosalind Franklin discovers the helical shape of RNA/DNA nucleic acids. (1951)	Nuclear power becomes the primary energy source in Arco Idaho in the US. (1955)	First transatlantic telephone cables. (1956)
First female contraceptive pill is developed (1954)	Revelle and Keeling announce potential problem of greenhouse gas emissions and begin a study of the levels of carbon dioxide in the atmosphere. (1957)	Texas instruments devise and market the first hand held calculator (1967)
Fibre optic endoscope is tested on human patient. (1957)	The idea of solar wind is put forward by Eugene Parker. (1958)	First use of the computer mouse to demonstrate how text files could be clipped, copied and pasted. (1968)
First oral polio vaccine developed. (1962)	TIROS-1 is the first meteorological satellite to be launched. (1960)	Silicon chips used for the first time in computer memory applications. (1970)
Lasers first used in surgery. (1985)	Apollo 8 is first manned spacecraft to orbit the Moon. (1968)	First email message sent. (1972)
Materials scientists develop synthetic skin. (1986)	General Motors introduces the catalytic converter. (1974)	First portable cell phone call made. (1973)
Invention of disposable contact lenses. (1987)	First world climate conference. (1979)	Formation of Microsoft computer software company by Bill Gates and Paul Allen. (1975)
Polymer water implants used to treat brain cancer. (1996)	Helen Sharman becomes the first Briton in Space. (1991)	Release by IBM of first personal computer complete with Microsoft operating system. (1981)
Three blind patients receive the world's first bionic eyes comprising 3,500 microscopic solar cells which act to convert light into electrical impulses. (2000)	Satellite observation of Hurricane Andrew enabled thousands of people to evacuate threatened Florida areas. (1992)	CD-ROM devices introduced into computers. (1987)
Human genome project finishes with complete mapping of human DNA sequences. (2000)	World's first commercial wave power station opens in Scotland. (2000)	Tim Berners-Lee invents the World Wide Web. (1989)



Entertainment/Culture	Industry/Business/Finance	International
Colour television pictures are first transmitted. (1951)	First non-stick pans developed using Teflon. (1954)	Modern high explosives developed for the first time. (1955)
ITV launched in the UK. (1955)	Development of Scotchguard fabric and material protector by Patsy Sherman. (1956)	UN Conference on Solar Energy in the Developing World. (1961)
Stereo FM radio broadcast for the first time. (1961)	Launch of first small scale photocopying machine. (1958)	Friends of the Earth formed. (1969)
First computer game devised Spacewar. (1962)	Kurt Ziegler and Giulio Natta awarded Nobel Prize for their work on the chemistry of high polymers. (1963)	Control of Pollution Act passed in the UK, exerting tighter controls on industrial pollution. (1990)
First video game invented by Ralph Bauer. (1967)	To improve vehicle safety, Pontiac develops bumpers that partially absorb the energy of a collision. (1967)	Alliance of Small Island States demand a 20% reduction in global emissions by 2005 fearing they might disappear under rising sea-levels. (1994)
Invention of synthetic alternative to grass – AstroTurf. Introduced into American sports stadia and patented. (1967)	Bar codes scanned using lasers are placed on shopping products for the first time. (1974)	Kyoto Protocol on reduction of carbon dioxide emissions agreed. (1997)
Kodak launched the instant colour camera. (1972)	General Motors introduces the catalytic converter. (1974)	World population surpasses 6 billion. (1999)
Fuji develop and market the first disposable camera for photography. (1986)	Concorde the first commercial supersonic aircraft is launched to the public. (1976)	Research suggests supply of large fish in the seas has diminished by 90% since 1950. (2003)
First Digital Versatile Disc (DVD) players launched in Japan. (1996)	Synchrotron light source becomes operational producing X-rays for structural analysis. (1981)	Devastating tsunami generated by an earthquake of magnitude 9.0 claims 300,000 lives across Indonesia, Thailand and India. (2004)
First digital TV channels available in the UK. (1998)	Volkswagen began testing photovoltaic arrays mounted on roofs of vehicles to tap solar energy. (1982)	England's pupils placed in top 10 for science and maths in global league table. (2008)
Apple's iPhone goes on sale with features including touch screen, media player, wi-fi, camera and web-browser (2007)	Launch of two biodegradable plastics. (1990)	Minister announces more 'flash and bang' needed to enthuse pupils in school science as a 21% drop in positive attitudes is recorded. (2008)