TGGS STEM 2014/2015 Newsletter

STEM is an acronym for science, technology, engineering and mathematics. Over the last year, Torquay Girls' Grammar has focused on raising students' enjoyment of, enthusiasm for, and achievement in STEM subjects, with the aim of becoming a STEM centre of excellence.

STEM subjects are integral to the UK's success: the UK is the world's sixth largest manufacturer, engineering turnover is around £800 billion per year, and whilst the UK makes up only 1% of the world's population, we produce 10% of the world's top scientific research. Despite this, it is remarkable to note that even though STEM graduates have the potential to earn amongst the highest salaries of all new recruits, employers are finding it difficult to recruit STEM skilled staff. Alongside our need for a skilled STEM workforce, it is crucial that all young people, regardless of their future career pathway, have the STEM knowledge and skills they need to be an informed citizen in an increasingly scientific and technological society.

By reaching outside their own classroom, teachers are collaborating across subjects, enhancing and enriching the school curriculum, making links with the world of work and using varied contexts to help our students relate school STEM subjects with their real-world experience. Since September, this has included talks, trips, events, clubs, challenges and competitions.

Trips

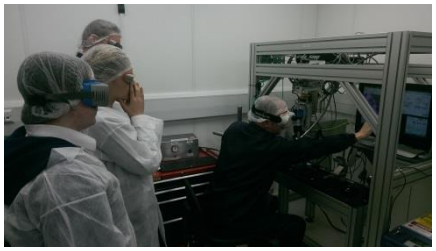
In December, fifteen key stage five students interested in STEM careers, attended a Women in STEM event at UTC Plymouth. There were over 25 exhibitors covering a vast array of careers ranging from Radiology and Robotics to Civil Engineering and Medicine, Nursing to Electrical Engineering, The Armed Forces and Microbiology, to name but a few.

In January, year 8 had a fabulous day experiencing some hands-on science during their visit to At-Bristol. Apart from the planetarium and many activities crammed into the day, there were workshops on electricity generation, colour chemistry and gravity.

Lots of STEM trips happened in March. The Mathematics

department took fifteen, year ten students to a further maths conference at Plymouth University. During the day the team took part in a competition, attended a bubble lecture and two workshops on

- centres of mass which lead up to finding the centre of mass of a student participant.
- Royal Statistical Society Centre for Statistical Education (RSSCSE) workshop which involved the collection of data, the use of computers and a careful consideration of the conclusions that could be reached.



Also in March, eight key stage five students considering studying engineering at university visited Gooch and Housego, an engineering company based in Torquay that specialises in glass and precision optics. Here, they learnt about fibre optics, their uses and recieved hands on experience of fusing optics together to help solve problems.

Finally in March, the school visited Naples as part of the Teaching Seismology in School Project. We visited excavation sites, temples and took a trip to the **Phlegraean Fields, which** is a large volcanic area situated to the west of Naples. It was declared a regional park in 2003. Lying mostly underwater, the area of the caldera comprises 24 craters and volcanic edifices.

Clubs

To enrich the extra-curricular experience of our students, existing clubs have been joined by several new clubs this year, which are going from strength to strength.

Junior STEM club has carried out several projects covering chemistry (floating lemons) and engineering (tower design and construction). With the oncoming (hopefully) improvements in weather, the theme for this last half term of the year will be more environmental based with the students working together to design and make an outdoor classroom that can be used for STEM activities. The senior STEM club has entered competitions, gone on trips, run whole school events and have helped organise the junior STEM club. Several of our students are entering the Gold Crest Award alongside the extended project. Titles range from "Why does explicit symmetry breaking occur in effective quantum fields?" to a team of students that are designing and making a prototype of a new bicycle light.

The Key stage three Chemistry Club has had so many students this year that they have had to be split into two groups! The groups have carried out a plethora of activities to look at various themes within Chemistry. The club explores investigative topics not on the curriculum for Y7 and has included growing and looking at crystals, displacement reactions and using chemistry to produce photograms. Next year we are going to be looking at chemistry in art, based in an RSC project, and chemistry in photography producing and toning prints.

Mr Mansfield also runs a weekly Chemistry Challenge club in the Autumn and Spring Terms for key stage five. The club look at demanding chemistry questions (Olympiad style) and some more cammanding practical work.

New for this year is the very popular Astronomy Club. The club meet weekly and have looked at topics such as learning how to label the stars in a constellation, making a planisphere, finding the coordinates of stars in the celestial sphere: using star charts, lunar landers, craters and 3D constellations.

A range of year 7 to 11 girls took part in Programming Club this year, run by Mr Sutton. They learnt the basics of writing a program in C, a powerful programming language at the core of every PC. Armed with a founding in the structure and components of computer code, they created our own programs, including one which asked the user to type in a sequence of notes then played them as a tune, and one which displayed a bouncing 3D cube with a picture of a cat on each face! The skills they have learnt will be useful not only for future programming projects but for any area of life involving logical thinking and problem solving.

Events

In March TGGS hosted our first STEM careers conference. We were very lucky to have Dr Ceri Lewis as our keynote speaker. She is a nominee for WISE hero award, an experienced marine biologist with expertise in how environmental change and pollution affects reproductive processes in marine animals and currently holds lectureship position at Exeter University. The other presenters on the day were inspirational and showed our students as well as those from other local schools the range of careers available within STEM industries. Speakers included a Systems Manager, Accountable Pharmacist, Environmental Chemist, Gas Network Engineer, representatives from Engineering Development Trust, computer programming, hardware engineer and a Senior Lecturer in Mathematics at the University of Exeter.

Also in March was the British Science and Engineering Week. Mr Mansfield wowed several students and staff with a dazzling display. Students explored the world of the school pond within biology. The week

concluded with a science quiz organised by the Year 12 Chemistry Prefects.
The three winning teams were:

- The Y13 team: Yelena Alton, Rohanna Brown, Rachel Kealy and Martha Bowles;
- The Y11 Fredlings: Ada Carpenter, Sophie Webb, Rebecca Rogers, Harriet Ridler, Anita Tomy and Ellen Ward;
- KS3 B team: Chloe Parr, Daisy Crisell, Rebecca Chamberlain, Eve Bell, Gemma McBain and Amy Brooks.

Competition

This year has been a busy year of competitions, ranging from the interhouse science quiz during science week to international quizzes.

Georgia Mitchell and Minnie Lou from the senior STEM club entered **The World Skills Environmental Science Competition**. It was an exciting challenge for the girls who are interested in environmental issues such as climate change, environmental conservation and protection, and the sustainable use of natural resources and energy. During the competition the students had to construct an environmental plan for the new government. They are waiting to hear if they have met the required standard to be invited to compete at the UK final at the NEC Birmingham.

Three year 11 students have entered **The IoT World Forum Young Women's Innovation Grand Challenge,** a global innovation challenge open to young women between the ages of 13-18. By 2020 there will be 50B devices connected to the internet which will make things more efficient, solve new business problems and improve people's lives. Already, many devices are connecting to the internet at an unprecedented pace.The aim of the challenge is to recognize, promote, and reward young innovators as they come up with new uses for Internet of Things technologies. The girls have looked into areas that they see as a problem today or expect to emerge in the next 5 years and how connecting more devices and everyday objects to the internet or other networks could help to solve these problems?

They have come up with the idea of an app that would link with heart pace makers, to allow patients to monitor their own heart rate and blood pressure at home. In the first istance would relieve pressure on the NHS but with the combination of a GPS and instant signal to 999 services would allow immediate response to a patient if their pace maker failed.

In February of this year, a record 6,189 students from 582 schools took part in the **British Biology Olympiad (BBO)**. The first round consisted of two one hour multiple choice papers taken online in schools. Rebecca Lee, Charlotte Harrison and Alana Crago who got Silver or Bronze awards, have been invited to attend a Society awards ceremony later this year.

In April all year 10s took part in the **Biology Challenge** run by the Society of Biology. The competition aims to involve as many 13 to 15 year old pupils as possible in a challenging and interesting biology competition and to encourage and interest pupils in a science subject

before they make their crucial choice of subjects to study post-GCSE. Our girls did incredibly well with one gold for Nandaja Narayanan, eight silver, thirty nine bronze, thirty one highly commended and thirty one commended. Well done girls.

Our girls also succeeded highly in the **Top of the Bench Competition** run by the Royal Society of Chemistry. Our intrepid girls were Isla Lindsay, Y11, Rebecca Stoyle and Lucia Moussali, Y9 and Louise James, Y10 who took on teams from eight other school and came home in an excellent equal second place. They were enthused, excited and encouraged to consider further education and careers with chemistry. They had to participate in two challenging practical activities; one, a series of titrations and the other an analytical exercise to identify different ions. Finally, they partook in a multiple choice test on general chemistry. Well done to all four for their excellent work!

Lots of cometition s are entered by the Mathematic department. All of the girls in Year 7 and the top two sets in Year 8 are entered for the **Junior Maths Challenge**. This is a national competition run by the United Kingdom Mathematics Trust. Students in set one in Year 9 enter the **Intermediate Maths Challenge**, and there is also an opportunity for four girls from Years 8 and 9 to represent the school in the **Junior Team Maths Challenge** competition in Plymouth.

Extras

Torquay Girls' Grammar School finally learned on the 17th September that it had been successful in gaining substantial funding from the European Union through its Erasmus + programme. The school will partner other schools in the UK, France and Italy and over the next two years engage in collaborative activities with staff and students looking specifically at using practical measurements of earthquakes as an inspirational tool to help students learn about geology and general science topics. Ultimately their work will be of great interest to other places of learning around the world but especially those who live and work in seismically active areas.

The Torbay HiTech Forum works to ***"Create a World Class environment for innovative, collaborative and technology-driven businesses in Torbay & South Devon - where advanced skills growth, research & engineering shape our future economy."*** Torquay Girls' Grammar are part of their Education Sub Group, where we have direct links with local STEM businesses that are looking for engagement with the next generation of talent and inspiring young people to pursue a career in technology or advanced manufacturing.

The Future

After such an amazing STEM year so far, we are keen to continue to enhance the STEM opportunities available to our students.

In June on Challenge day our Year 7s will be visiting Paignton Zoo to investigate "What is the future for farming?" Is current food production sustainable? This session looks closely at the food we eat and the impact of its production on the environment. We will explore more sustainable alternatives and students can even taste edible insects for themselves.

Also on Challenge day the year 9s will be travelling to Buckfast, to use maths in practical contexts. They will be looking at:

- Accurate measuring and scale drawing using geometry of circles to assist with construction, of the arches within the abbey.
- A critical path analysis of the construction of the bell tower, ordering written information, deciding which task has to be done when.
- A merchandising/sales activity. Sorting and checking a delivery sheet, pricing and mark up considering various VAT codes and profit margins for different types of product.

There are also lots of lunchtime careers talks planned over the rest of the term and into the new year, including Centrax, who are a local business that have over 65 years of experience in the engineering industry. They have a worldwide reputation for quality and reliability in the power generation and complex component manufacture markets.

In June all year 10s will be attending a talk by Peter Shrubsall. Peter is a retired engineer who trained with Rolls-Royce Aero-Engines and has worked variously as a manufacturing and design engineer but with many years concentrating on commercial, sales and marketing to many industries. Latterly this was the railway industry. For the last 13 years of his career he was Managing Director of a design and manufacturing company in Plymouth culminating in a Queen's Award for Innovation. For the last few years he has been a highly active STEM Ambassador, encouraging students into engineering and technical careers.

In July we have representatives from the Institute of Physics coming in to talk to years 9 and 10 about "Beautiful brains and amazing lasers; the secrets of biophotonics".

Most people are familiar with laser technology to some extent. You have probably seen or used laser pointers in machines like DVD players for example. What you might not know is that lasers can also be used to get information from biological samples.

The talk, will explain the science behind pulsed lasers, and how these special "non-linear" optical effects take images of biological samples like brains, intestines and skin, and how they can trace the path that certain drugs take inside these samples. This helps us understand how new nano-medicines work at the cellular scale inside biological specimens, and this will help us to make more effective treatments for diseases of the brain like cancer and Alzheimer's in the future. The speaker, Natalie Garrett is a Biomedical Physics research scientist at the University of Exeter.

Finally, Torquay Girls' Grammar are also proud to announce that from September we are joining with The Torbay Development Agency for the pilot of the MADE (Manufacturing Activities Designed to Engage) Project. It is a series of manufacturing focussed activities designed to inspire, motivate and engage participants in STEM learning. The MADE pilot will support and encourage businesses and educators to work collaboratively to develop activities which challenge and stimulate in order to ensure young people are sufficiently equipped with the necessary skills and competencies required to be employed within the

Manufacturing sector, and to progress throughout their careers. Additionally, this project will also look to raise the profile of careers within the manufacturing sector and of the opportunities available locally, both now and in the future.

Overall, a fantastic year of STEM at TGGS. Our aim for this year was solely "To raise the profile of STEM to our girls". I am sure that you can see from the summary above that it has been a busy year! However, we intend for next year to be even busier. Why? Not only because we can see that it is our duty to make girls aware of the vast world of STEM that is available to them when they leave us, but because STEM increases commitment, team skills, leadership, planning and problem solving. These skills are applicable to all curriculum subjects and will help raise standards.