

# Science Technology Engineering Maths

## A whole school approach to STEM

Redmoor Academy STEM Club

February 2015



**Our focus has always been to embed STEM learning across the curriculum, to promote the diversity of STEM careers that will be available for our students in the future, to support and encourage our feeder schools in their bid to develop their own STEM activities and finally to give our young pupils a taste of what engineering, specifically, truly is, in its myriad of applications.**

*We aim to ensure that all pupils, regardless of age or academic ability, have access to a wide range of science, technology, engineering and maths activities in the hope that they will be inspired to engage in their studies and find that spark of imagination to drive them towards their goals – whatever they be.*

Jo Cox Senior Leader STEM Redmoor Academy



The successful STEM provision at Redmoor Academy has a huge impact on engagement, is popular with all year groups and abilities and is widely supported by STEM teachers across the school.

Whilst we refer to the 'Redmoor STEM club', this is, in reality, an umbrella term covering almost 20 different clubs and initiatives. Science teachers, IT teachers, DT teachers and maths teachers all help to promote STEM learning and we are supported in this initiative by other colleagues during cross curriculum activities.

This year has seen a huge amount of support from the geography department, the drama department and the English department.

Our initiatives are fully supported by the Senior Leadership Team who give us the freedom to pursue the wealth of initiatives that we get involved with.

This year, we have developed a plethora of industrial partners all helping to promote STEM careers and skills to our young students as we continue to work towards narrowing the gap between industry and schools.

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# 1 - Achievements

Redmoor Academy was accepted into the Institution of Secondary Engineers in Dec 2014

We were awarded the Young Engineers 'Club of the Year' title in March 2014

We were finalists in the STEMNET 'STEM club of the year' competition in December 2013 and nominated for the award of 'Most Dedicated STEM club' in 2014.

## Other successes are as follows:

Winners of best overall project **2013** [*Hinckley Science Festival*]

Winners of best project with energy/water related theme **2013** [*Hinckley Science Festival*]

Winners of Prize for Enthusiasm **2013**[*Regional Big Bang*]

Winners of Best CREST project (Bronze category) **2013**[*Regional Big Bang*]

Winners of the East Midlands regional competition **Dec 2013**[*First Lego League*]

National Finalists **January 2014** [*First Lego League*]

Champions award East Midlands regional comp **Dec 2014**[*First Lego League*]

National Finalists **January 2015** [*First Lego League*]

NSEC Finalists 2015: STEM on the Severn

NSEC Finalists 2014: Saheefa Ishaq studying the issues behind food hygiene (winner: CREST award for communication), Jamie Kettle studying the effects of caffeine on heart rate (winner: Junior scientist of the year)

NSEC Finalists 2013: Mucky Mobile Microbes, Saheefa Ishaq studying cleaning products and efficiency (winner of Broadcom Masters prize, Runner up Junior scientist of the year),

Winners of the pilot competition **2013**(*Talent 2030 Engineering for girls*)

Runners up of the pilot competition **2013**(*Talent 2030 Engineering for girls*)

Finalists Eleanor Mifflin 2014 **2014**(*Talent 2030 Engineering for girls*)

VEX teamwork award **regional event 2014**

VEX National finalists March 2015 (\*\*\*\*latest achievement)

Greenpower formula 24: **Portfolio award 2014**

Go4SET student vote winners East Midlands Region **2014**[*IET*]



## 2 - Young Engineers Activities

Having had a long affiliation with the Young Engineers of Great Britain, we were delighted to be awarded the title of Senior Club of the Year in 2014 at the Big Bang event in Birmingham. The students displayed several projects that they had been involved with over the previous year including:

- A new nose cone for Paperweight (Greenpower Engineering)
- STEM Amanshi (a water filtration project for our Zambian partner school)
- The Island school (GoSET)

Building on that award, we developed a Primary STEM liaison group using activities from the Launch pad membership pack and encouraged our primary feeders to sign up too.

The resources from this pack were also developed and used during a presentation at Leicester University to encourage more science technicians to take up the running of STEM clubs. The flip car proved very popular at this event!

In May 2014, as part of our Active Learning Programme of events, 24 students took part in our own version of Project Eggs Factor to safely transport their eggs across the school hall – this was a popular activity with the students who had not previously been engaged in STEM activities outside of lessons.

In December 2013 we welcomed representatives from the Young Engineers to our very first Big Bang event where they ran a fabulous marble run challenge as well as a special Christmas themed engineering activity to drop Santa's toys down the chimney. This proved very popular with our young KS2 visitors.



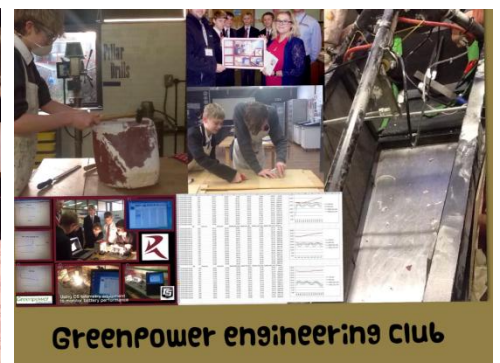
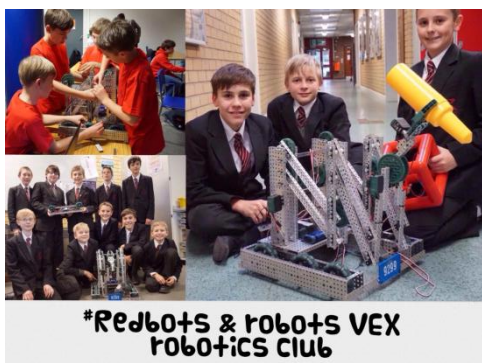
# 3 - STEM Activities with other providers

In 2014 we took part in the IET [Go4SET](#) project whereby pupils worked alongside 2 engineers from Babcock to design and model an island school. All year 9 pupils were invited to take part from which we chose a team of 8 pupils. They went on to present their work at the regional final and were awarded the Student vote by their fellow competitors. As part of the scheme, they were able to visit the manufacturing site and learnt for themselves the input that Babcock have into defence system engineering.

In 2013, Caterpillar, who are a local company, agreed to sponsor us through the [First Lego League](#) (IET). Now in our second year, the team have had phenomenal successes and have yet again made the National Finals. The team is run by Ian Harcombe, who teaches computing and ICT at Redmoor Academy. The 10 year 8 pupils who took part in the first year (chosen because of their ICT skills) worked as mentors to the new Year 7 pupils who have joined the group.

Redmoor Academy began a [Vex Robotics](#) club in spring 2014; run by Hannah Spencer (science) after all local schools were sponsored with a starter kit, supplied by the National Grid. Since then the club has grown dramatically. After building the basic Clawbot, the 'Redbots,' as the team is known, have entered the main competition for the season 2014-15. The club consists of around 15 pupils, all with different roles: some as programmers, engineers, team leaders. Pupils in 'Redbots' are also involved in event management, fund raising and social media management. Pupils in the club are of all academic abilities. From further local sponsorship from the National Grid, we have invested in Vex IQ kits to introduce robotics to the younger year 7s as well as including disengaged pupils in other year groups.

The [Greenpower engineering](#) club, run by Charlotte Burton (science) has around ten members five of whom regularly attend. The club is divided into two sessions; data and design engineering. The data sessions are about our data logger which records battery usage and temperature for each race while our design engineering sessions are about improving the design of the car. Pupils so far have designed a new nose cone and are in the process of designing and engineering new bodywork. They have also been using a telemetry system to improve performance of our batteries. Last year we took the car (Paperweight) to Rockingham where we took part in two races being placed 52nd out of 64 teams. We hope to significantly improve upon this in the coming year. We did however win the Portfolio award demonstrating engineering progress over the year.



# 4 - Major Activities and competitions

We have been involved in various competitions as identified in our achievement page and currently have pupils entered into the Talent 2030 competition, the National Science & Engineering Competition and Discovery Friday (which is a new CREST initiative). Alongside this, we have several pupils working on their own engineering projects undertaken as part of the Engage Enjoy Engineer course.

We have been involved in two major projects this year, both aiming to give pupils an insight into future careers. The first of these projects, **STEM on the Severn** was run in collaboration with a team of scientists from Anturus who were paddle-boarding down the river Severn on an expedition. We joined forces with this group of scientists and set the pupils to work as the lab team, completing work both in the lab and on the river. This really was real science for our future scientists and the film of the project can be viewed here:

<https://m.youtube.com/watch?v=HJmQs4pLH9Q&feature=youtu.be>

This team are now through to the National finals of NSEC and are busy analysing the collected samples. This project saw first-time collaboration between the STEM departments and the geography department and attracted another cohort of pupils who had not attended STEM sessions before.

The second major project we have been involved with this year is the **Engage Enjoy Engineer** course. All pupils in year 8 and 9 were invited to apply and we chose the first 28 applicants, regardless of ability. This has been run in conjunction with the Intuition of Secondary Engineers and the aim was to fully immerse our pupils in the knowledge of engineering careers. With the help of various local engineering companies the pupils were instructed in the various fields of engineering, completed various challenges, designed their own engineering projects and took part in a debate about which field of engineering is most important in the 21<sup>st</sup> Century.

This course attracted a great deal of interest from the industry sector as it was designed to equip our pupils with the skills they require for working in the UK engineering industry. Here is what one of the engineers said about the course:

***"If the goal of the Engage Enjoy Engineer course has been to engage pupils in STEM subjects whilst demonstrating how Engineering can be fun, then it has clearly been a huge success. It's both refreshing and rewarding to see such enthusiasm for Engineering topics; We often hear about the skill shortage and the lack of professional Engineers in the UK, in my opinion it's courses like Engage Enjoy Engineer that will help to address this problem by inspiring students to consider Engineering at an earlier age. Being able to give students an Engineering accreditation at such a young age is a great incentive for them to continue with STEM activities, and I would be very surprised if it didn't lead to an increased take up of STEM subjects at GCSE and A Level, and also higher numbers of applications for apprenticeship schemes."***



# 5 - Engineering club activities & Curriculum based STEM learning

The aim at Redmoor is to provide a wide range of activities that capture the imagination and interest of all our pupils. In March 2014, the whole school experienced the application of STEM subjects in a talk about **Survival Science**. In the summer term, all pupils took part in an RCS **global experiment**. Year 7 pupils who were deemed gifted and talented in geography took part in an EON sponsored **SmallPiece Trust** activity to design and build a biofuel generator. Year 8 pupils took part in a range of **Tomorrows Engineers** activities ranging from an introductory lecture to hands on workshops. The workshops were aimed specifically at middle ability year 8 pupils to inspire them to think more about the application of engineering. These workshops proved very popular and several pupils commented on how much they had been inspired to think about engineering as a career. Where possible, we try to provide our pupils with a range of themed activities that coincide with events in the real world. This academic year, to date, we have supported **National Space Week** and **Tomorrows Engineers Week**.

In order to make sure we are fully equipped to inform and instruct our pupils, teaching staff at Redmoor Academy take part in regular CPD STEM activities. For example, all the science staff are currently engaged with the **Stimulating Physics Network** and are developing techniques for inspiring more girls to pursue a career in physics. In October I took part in the National STEM Centres' **Teachers Industrial Partners Scheme** which proved invaluable in supporting our engineering initiatives.

In their Design Technology lessons, pupils are learning about the following applications:

- Bio mimicry in fashion design ( yr9 course)
- Inclusion of the concept of sustainability in global textiles( recycling, world cost of textiles, the geography of jeans)
- The impact of textiles in the water systems
- E textiles (yr8 Doorstops) Basic circuits in textiles to control lighting systems.
- The composition of fabrics - man made vs. natural (yr7 course)
- Mathematics in fashion (yr9 course) developing patterns
- SMART textiles - currently investigating thermo chromic fabric paints'

In their maths lessons, pupils have been taking part in the following initiatives:

- Maths in everyday life experience at Nottingham Race Course, working with the British Horseracing Education and Standards Trust – engagement activity for lower ability year 7 and 8 pupils to help them see the relevance of their maths studies.
- Athletics project work –the year 9s current project is to research and design a garden working within a strict budget – putting the M firmly into STEM!
- Edge Hill University problem solving competition for year 9 pupils.
- UKMT maths challenge – all years
- UKMT team challenge for years 8 and 9.



Year 7 & 8 students also took part in the **Great British Make Off** competition run by the Design and Technology Association. Students had to design a new product to aid cyclists, and create their own video to advertise and explain their innovative product. Year 7 & 8 students also designed a new header for the website for the 'Drawing Tool Company'. They entered a design, and although they didn't win they were sent a free 'Isosketch tool' which will help them with their drawing skills.

3 year 9 students are building (by them self!) a replica of a world war 1 canon in their own time at lunch times, they are building it all using a real design specification but using wood instead and in Props and Scenery club, pupils are using their DT skills to enhance the school production.

We also provide **programming opportunities** for pupils who are interested in extending their learning on a variety of programming tasks, from Raspberry Pi to 3d animations.

## 6 - Feeder school engagement

Since being awarded the title of ‘Young Engineers Club of the Year’ we have worked with our partner schools on various initiatives including providing an **extended schools STEM workshop** during the summer holidays, setting up a **Primary STEM liaison group** to support KS2 teachers to set up and run their own STEM clubs and our showcase event – the **Big Bang @ Redmoor Academy**. Around 230 Redmoor pupils helped to run the day and worked as STEM leaders in various roles such as caterers, KS2 helpers, exhibitor support, co-teachers, VIP guides, media personnel and many more.

The rest of the Redmoor pupils were joined by over 500 KS2 pupils from 16 different primary schools. There were numerous STEM activities on offer provided by over 30 exhibitors and organisations as well as Redmoor's own excellent science buskers. Huw James provided the headline shows and wowed everyone with his take on Christmas themed bangs and explosions, not to mention the leaf-blower powered hovercraft! Other popular activities were the 360 degree Immersive Theatre which taught visitors how to locate the North Star, the Leicester University Chemists who made gallons of ice cream using liquid nitrogen, and the team from Pulse CSI who ran a forensic workshop to see who had killed Santa (fortunately they were false allegations!). The programming workshops, the VEX robotics, the Bloodhound engineering event and in fact all the activities proved to be very popular and have been individually and collectively praised in the feedback received from students and teachers alike. As one Year 5 pupil from Townlands Primary school put it: “This was the best day of my life.” A review of the event can be found here: <http://www.redmooracademy.org/web/?q=node%2F1224>

The hope was that KS2 teachers would take ideas back to their own schools and enhance their delivery of STEM activities. Since the event, we have had several schools contact us about events they have planned. This feedback is typical of messages we received after the event: ***“Wow! So much hard work and effort was put into the Big Bang. It was an amazing day for all both teachers and children. Thank you. Also a big well done to our group LSA's. They were fab and really helpful. Can't wait for next year and got loads of ideas for science club too!”*** (KS2 teacher Big Bang @ Redmoor Academy)

Our latest initiative is to take STEM to the performing arts corridor to develop a new group called **the STEM Performers** who will ultimately be ‘teaching’ primary school pupils about various engineering concepts through the media of dance and drama.

## 7 - STEM activities in the wider community

As well as supporting other organisations wherever we can , either through the support of social media channels - (we now have over 1000 people following our activities via Twitter) - or by visiting their science fair events, Redmoor staff and pupils have worked tirelessly to share their knowledge and expertise.

Since June, our [science buskers](#) have supported the Big Bang fair at Castle Rock High School as well as the Big Bang at Daventry UTC.

It is hoped that the Vex IQ can be used to provide [parent /pupil events](#) and used within the community at future Big Bangs held at the school. This is something that we are currently developing. We have hosted our own VEX scrimmage events at the school, for local schools to take part in, and later this month we will be hosting our first [regional VEX event](#) - schools from across the county are expected to attend. A further aim of this event is to encourage local schools in the Hinckley and Bosworth area to take the next step into the main competition of Vex robotics.

We are currently investigating the feasibility of running a [Girls in Engineering day](#) in June to coincide with the National Women in Engineering Initiative.

This year, we extended our [Big Bang event](#) to offer these STEM experiences to the local community. We had just over 300 visitors which was positive considering it was held 2 weeks before Christmas. The headline entertainment was provided by Mathew Tosh who presented his 12FX of Christmas and we were delighted to welcome the Enterprise Soap Box to Redmoor for the first time. Many of our visitors had great fun making soap-based Christmas gifts for friends and family in an activity that aimed to introduce youngsters to the idea of business and enterprise skills. This is one of the comments we received from the exhibitors: ***'It was great to be involved in something so community focussed and exemplified the work of a school that is getting STEM education so right. It was so inspirational see the scope and variety of talent and projects being nurtured in school and all the external support that has attracted. We had lots of excited families on the day'***

One of the overwhelming success stories from our point of view was the impact on our own [STEM leaders](#). All pupils in Years 8 and 9 were invited to take one of these positions regardless of academic ability or previous achievement. A huge number of pupils played a major part in the organisation of the event and at times it was difficult to remember that these pupils are just 12 to 14 years-old. Visitors commented over and over about their attitude, maturity, behaviour, willingness to help and enthusiasm. We saw pupils displaying skills that would never normally be witnessed in lessons – they worked alongside the adults doing the jobs of the adults and demonstrating an ability way beyond their years in many cases.

## 8 – Public Relations engagements

Due to our many successes we have been invited to take part in various events. We consider it very important to share expertise at every possible opportunity. We have worked alongside the Practical Action team to develop their STEM challenges, attended the ASE conference to share experiences of the Teachers Industrial Partners Scheme (at the invitation of the IMechE). I will be delivering a presentation at the Westminster forum about closing the gap between industry and schools and our pupils have been invited to attend the Houses of Parliament (by the National STEM Centre) to showcase the Engage Enjoy Engineer course.

STEM engagement is not just about what happens in our school with our pupils, it is about observing the bigger picture and ensuring that all students, up and down the country have access to STEM experiences.

## 9 - Our Industry Partners

These are the companies and engineers that we have worked with in 2014:

- Babcock Engineers supporting Go4SET
- Caterpillar supporting the First Lego League
- Caterpillar (Neil Portus) supporting Engage Enjoy Engineer
- National Grid (Jonathon Richardson) supporting VEX
- MIRA (Alisdair Bowie) supporting Greenpower
- Campbell Scientific (Iain Thornton) supporting Greenpower
- LATI Loughborough supporting Engage Enjoy Engineer
- Triumph Motorcycles supporting Engage Enjoy Engineer
- Manufacturing Technology Centre supporting TIPS
- Anturus scientists

# 10 - Appendix

## Feedback from Redmoor Academy Supporters

***"I enjoyed everything about the day, from how attentive and engaged the students at Redmoor are, to the commitment of the school in delivering high quality STEM engagement - it is phenomenal"*** (exhibitor at the Redmoor Big Bang 2014)

***"Fantastic event - massive variety of areas covered in ingenious and interesting ways."*** (Visitor Big Bang @ Redmoor Academy)

***"It was great to be involved in something so community focussed and exemplified the work of a school that is getting STEM education so right. It was so inspirational see the scope and variety of talent and projects being nurtured in school and all the external support that has attracted. We had lots of excited families on the day"*** (Exhibitor Big Bang @ Redmoor Academy)

***"The effort put in by all concerned was magnificent. As a retired former engineer, I was thrilled to see opportunities being so graphically demonstrated to today's young students. I think you can be proud of a job well done."*** (Visitor Big Bang @ Redmoor Academy)

***"I was most impressed with the way in which all the pupils were involved in the organising and running of the event. All must be congratulated on their helpfulness, politeness, hard work and smart appearance."*** (exhibitor Big Bang @ Redmoor Academy)

***"A thoroughly enjoyable event, well organised and a real buzz about the Academy from both students and teachers, great to see so many students engaging in various Scientific activities and importantly enjoying them! Well done Redmoor Academy for another great event, see you next year! If not before"*** (exhibitor Big Bang @ Redmoor Academy)

***"The kids at Redmoor Academy were fantastic. After a brief introduction to biomedical engineering we had them designing medical devices of the future, which they then sketched up and presented in a 'Dragon's Den' scenario. After hearing about everything else the kids had been up to in the previous weeks, I wish such an after school club was available at my secondary school! The session was really well organised by the school staff and I look forward to visiting again in the future."*** Supporting engineer talking about Engage Enjoy Engineer

***If the goal of the Engage Enjoy Engineer course has been to engage pupils in STEM subjects whilst demonstrating how Engineering can be fun, then it has clearly been a huge success. It's both refreshing and rewarding to see such enthusiasm for Engineering topics; We often hear about the skill shortage and the lack of professional Engineers in the UK, in my opinion it's courses like Engage Enjoy Engineer that will help to address this problem by inspiring students to consider Engineering at an earlier age. Being able to give students an Engineering accreditation at such a young age is a great incentive for them to continue with STEM activities, and I would be very surprised if it didn't lead to an increased take up of STEM subjects at GCSE and A Level, and also higher numbers of applications for apprenticeship schemes."*** Supporting Engineer talking about Engage Enjoy Engineer

***"This opportunity was very worthwhile in terms of introducing a certain aspect of Humanitarian Engineering. There is definitely an advantage having a lovely, equipped school environment, a very well organised and thought provoking programme and a bunch of intelligent and enthusiastic young people. Hopefully, the students are now not only more aware of the different fields of engineering but are also slightly more humanitarian balanced as well."*** Supporting Engineer talking about Engage Enjoy Engineer

## Web links

Hinckley times Big Bang 2014 review: <http://dlvr.it/8D5sz8>

Coventry telegraph impact of Teacher Industrial Placement scheme:  
<http://www.coventrytelegraph.net/news/business/manufacturing/teachers-key-solving-skills-shortage-8291428>

Hinckley times advertises the Big Bang 2014:  
<http://www.hinckleytimes.net/news/local-news/science-fair-opens-public-bang-8140691>

Engineering UK promote the Big Bang at Redmoor:  
<http://nearme.thebigbangfair.co.uk/Event/?e=2499>

Engineering Success for pupils: <http://www.redmooracademy.org/web/?q=node/1232>

Redmoor wins National Award for closing the gap – Opportunities for all:  
<http://www.redmooracademy.org/web/?q=node/1231>

Success at NSEC 2014:  
<http://www.leicestermercury.co.uk/Redmoor-Academy-pupil-Jamie-wins-prestigious/story-20837023-detail/story.html>

Practical action liaison:  
<http://practicalaction.org/beatthefloodredmoor-1>

Andy Coombs talks about STEM:<http://youtu.be/H9iZ8MW4A3I>

Huw James at the Redmoor Big Bang: [https://m.youtube.com/watch?sns=tw&v=aYY5YWJN\\_MI](https://m.youtube.com/watch?sns=tw&v=aYY5YWJN_MI)

Campbell scientific at the Big Bang: <http://youtu.be/EjWRr3mJ8TQ>

'Behind the News' feature tomorrow: How to get girls into STEM & closing the gender pay gap @BBCLeicester -  
Radio interview with Nicky Morgan and Wise:  
<http://www.bbc.co.uk/programmes/p029s1ch>  
(8 mins in)

The EEE experience the Bloodhound <http://www.redmooracademy.org/web/?q=node/1166>

EEE is launched: <http://www.redmooracademy.org/web/?q=node/1127>

Hinckley times Big Bang 2014: <http://dlvr.it/8D5sz8>