IET Faraday
Transforming your lessons

STEM in practice!

Mary Southall and Kevin Jones
Attainment Partnership Ltd

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Attainment Partnership Ltd

Kevin Jones

- deputy head of a Technology College
- AST
- cohort of 98 taking A. level design and technology
- SSAT National Subject Leader: Technology Colleges

Mary Southall

- HoD / senior teacher
- AST
- 100% grade A's at A. level (23 in the group!)

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what do we do?

- Working in a variety of schools **every week**
- The **Design Museum** (write and deliver secondary CPD)
- The **Victoria and Albert Museum** (write and deliver secondary teaching and learning materials for design and technology)
- The **Design Council** (member of the national 'Design Skills' advisory panel and chair of schools steering group) including **chief moderator Design Mark**
- Specialist Schools and Academies Trust **SSAT**
- Qualifications and Curriculum Development Authority **QCDA**
- **IET Faraday** STEM materials (write and deliver)
- STEM materials for L&T Scotland
- Buffalo State University, New York USA (write and deliver CPD)
- South East Asia international conference (present keynotes)
- HoK architects (advice on BSF)
- **D&T Association** (write publications, deliver CPD)

Free teaching resources from the IET designed to **transform** today's young minds into tomorrow's scientists, technologists, engineers and mathematicians **www.theiet.org/faraday**

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why STEM?

- UK plc!
- issues in schools
- practice that works!

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- UK plc need STEM skills

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the need for more UK STEM graduates

- 550,000 engineering companies in UK
- face a shortfall of 600,000 employees over the next ten years

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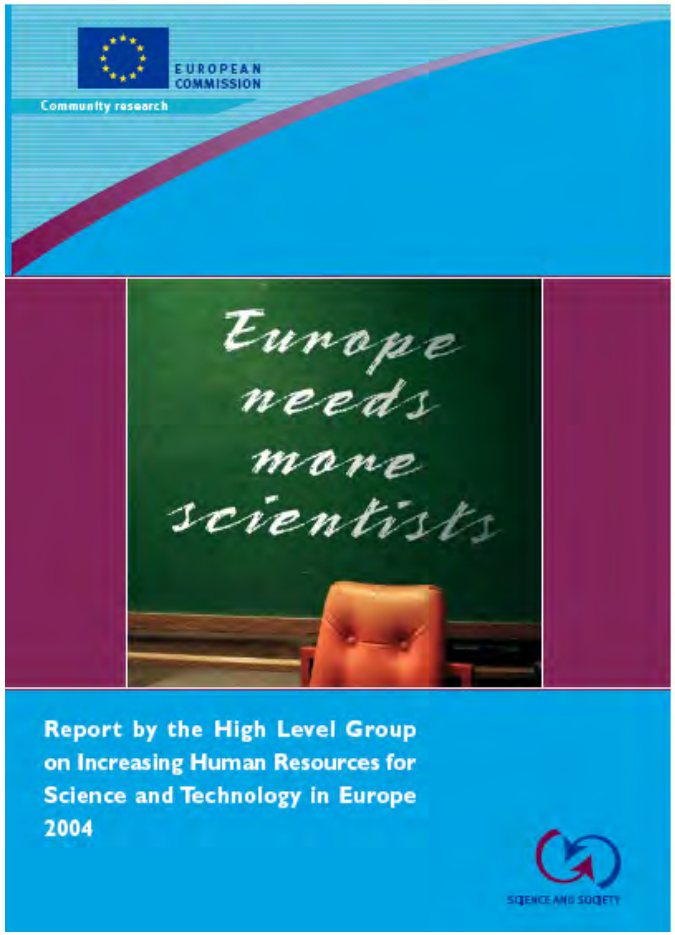
the need for more UK STEM graduates



More than **half of students** across all taught postgraduate engineering courses at UK universities are **domiciled outside the EU**. In some engineering courses non-EU domiciled students account for as many as two-thirds of places.

The findings of *Engineering UK 2007* clearly show the **need to improve the supply of suitably qualified engineers** and technicians in order to match the on-going and future anticipated demand for skills.
Engineering UK 2007 ETB

All bright children should be entered automatically for triple science at GCSE, covering physics, chemistry and biology. He also called on the Government to offer £1,000 a year to science, technology, engineering and maths under-graduates.

Richard Lambert, the Director-General of the CBI

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Queen Elizabeth prize for Engineering

The INDEPENDENT

£1m engineering prize launched

A £1m prize - named after the Queen - is to be awarded for exceptional advances in engineering.

The Queen Elizabeth Prize for Engineering: New £1 Million Global Award for Engineering That Benefits Humanity

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- issues in schools

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the secondary curriculum...

- greater coherence
- greater flexibility
- greater creativity

National Curriculum

QCA Qualifications and Curriculum Authority

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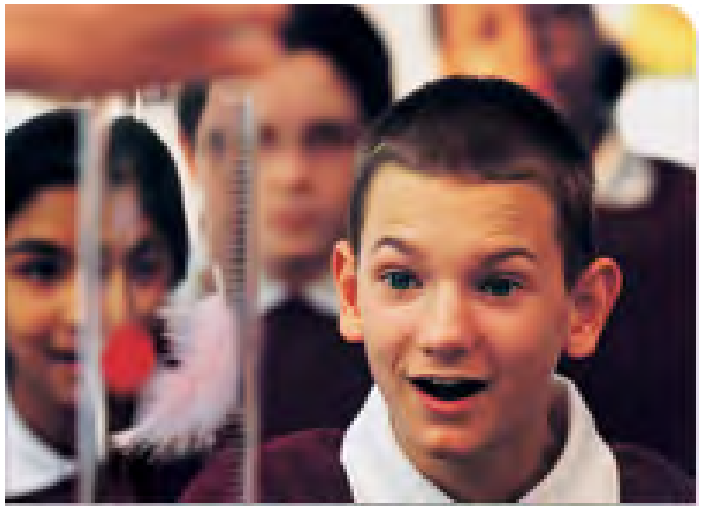
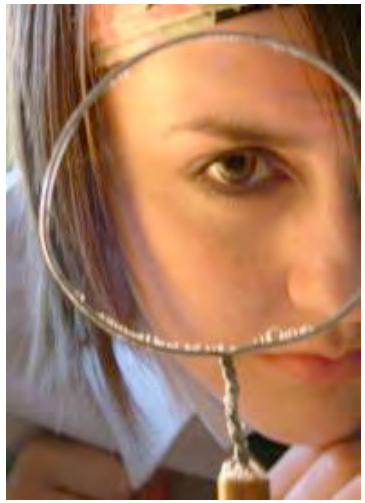
what are schools doing?

- **STEM is the new Literacy!**


- Science, Technology, Engineering and Maths Colleges have undoubtedly made strides to improve young peoples perceptions of STEM subjects

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altering perceptions of engineering

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issues in schools

- Assessment - finding a strand from each subject
- Planning -team planning
- Evidence of learning - give responsibility to the learner
- Timetabling/curriculum - delivery models

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assessing STEM activities

DANCE POWER: SUSTAINABLE DANCECLUB

These classroom activities look further into the scientific concepts and technologies behind the sustainable dance floor and relate directly to the 'Dance Power' Film. They have been designed for mathematics, science and design and technology and all activities are mapped to the new Secondary Curriculum and PLTS framework. The activities clearly relate to one another and would best be used as part of a programme of study.

Subject	Activity	Description	Content Focus
Maths	Dancing is Electric	A short but challenging activity in which students interpret and produce graphs modelling the energy produced on a sustainable dance floor.	Number and algebra
Design & Technology	The Shocking Truth	A research and development project focusing on the piezoelectric effect. A D&T activity with cross-curricular links with Science.	Systems and control
Science	The Psychology of Colour	Challenge your students to build on what they learned in the 'Shocking Truth' activity by understanding how engineers and scientists collaborate to develop ideas for practical applications.	Energy, electricity and forces; Organisms, behaviour and health
Design & Technology	The Power of Colour	Using the sustainable dance floor as a stimulus, investigate the psychological effects that colour has on humans.	The study of designing

Personal Learning and Thinking Skills (PLTS)

Several of the PLTS are emphasised throughout these activities. However, reflective learning was the key focus in the design of these activities.

Reflective learners: Young people evaluate their strengths and limitations, setting themselves attainable goals with realistic criteria for success. They monitor their own performance and progress, inviting feedback from others and making changes to further their learning.

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assessing STEM activities

Activity Name	England & Wales			Northern Ireland	Scotland
	Science	Design & Technology	Maths		
Energy Efficiency	Critical understanding of evidence 2.2.a, Communication 2.3.a, Energy, electricity and forces 3.1.a			Forces and energy transfer, The environment and human influences	Planet Earth, SCN 3-04a, 3-04b
Let there Be Light		Designing and making 1.1b, 1.1c, Apply knowledge and understanding of materials 2.c, Knowledge of others' designing 2.d, Practical application of systems and control 3.n		Design – identifying problems; investigating, generating, developing, modeling and evaluating design proposals. Control – incorporate control systems, such as mechanical, electronic or computer-based, in products and understand how these can be employed to achieve desired effects.	Computing science contexts for developing technological skills and knowledge, TCH 3-09a, Craft, design, engineering and graphics contexts for developing technological skills and knowledge, TCH 3-12a
Underground Pipes and Recycling			Representing 2.1.a, 2.1.d, Analysing 2.2.a, Communicating and reflecting 2.4.b, Number and algebra 3.1e, Geometry and measures 3.2h,	knowledge and understanding of; • number • algebra	Number, Money and Measure, MNU 3-03a, 3-05a

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planning STEM activities

- plan new activities as a team
- hand over existing activity and ask science or maths teacher to bring their 'bits' to life

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a maths activity?

Session One Activities

Activities	Diagnostic/High level questions	Questions for the team/comments
Introduction Using ppt slide 1 show the slide full of original sketches - Key learning = inventions start with simple ideas/sketches.  Ask students to discuss what these original sketches could have developed into. 1. Telephone – Graham Alexandra Bell 2. Telescope – Issacc Newton 3. Parachute - Leonardo 4. Machine gun - Leondardo 5. Helicopter – Sir George Cayley	*Extension activity – research Sir George Cayley (a fascinating figure with a very interesting life). Could provide some information in terms of social context to help make the link between technological development and society.?*	
Using ppt slide 2 ask 'How could it work' Using the images shown - In pairs, try and work out what produces the rotary motion. Ask the students to 'disassemble the model (in their minds eye) and write down all the different components 1. two corks – to attaché the feathers 2. 8 feathers – to provide the lift 3. Piece of dowell – to separate the rotary movement and provide more lift 4. String – to twist around the dowell and act as the potential energy.? 5. Bow – to help store the energy before it is released	A nice introduction could include making a paper helicopter - http://www.exploratorium.edu/science_explorer/roto-copter.html Need to make one and describe the components in more detail	A useful website – http://www.geocities.com/aerohydro/mfm/model.htm

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evidence of learning

- how do we capture evidence of learning across STEM subjects?

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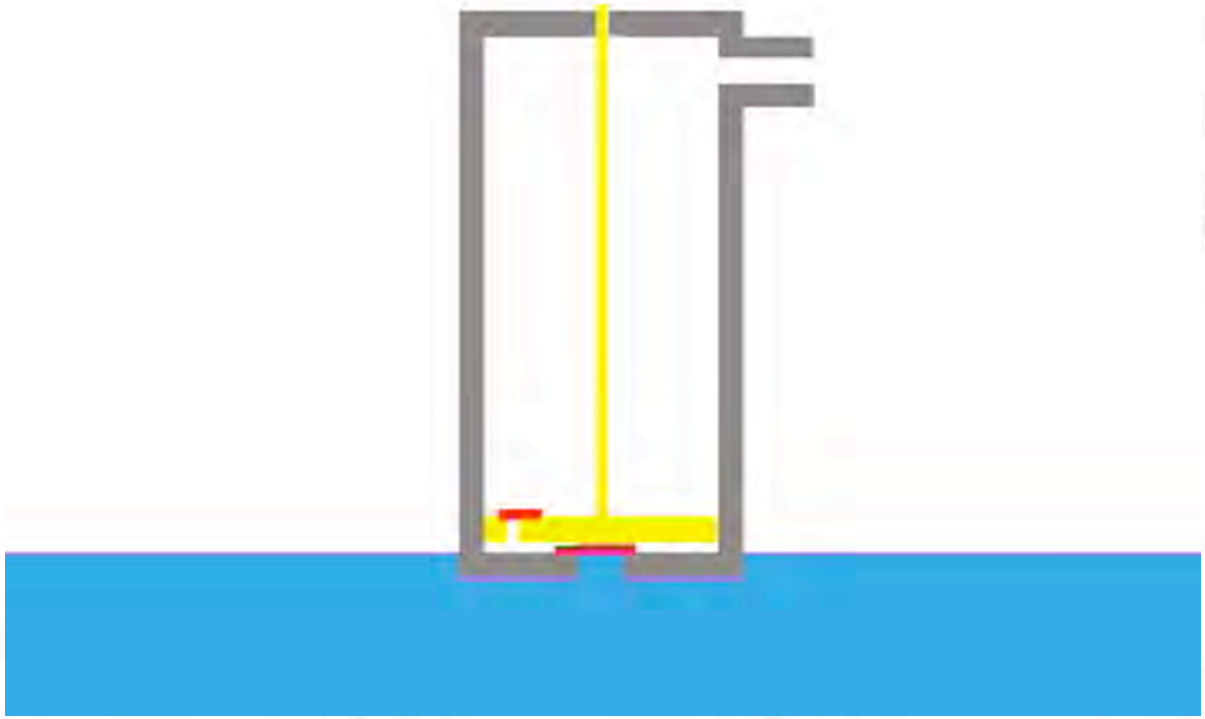
evidence of learning



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evidence of learning

Team 3!
LRGS!

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flexible and creative delivery models

- A whole year group in the hall – to kick start the activity
- A whole day event involving teams of students working on the various subject specific learning activities
- A sequence of learning activities e.g. maths, followed by design and technology and then science for the required period of time
- Lessons taught through the different subject areas, but constantly referring and reinforcing the learning in the other two.
- Work with your Primary schools, perfect for STEM activities

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whole day activities

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The Institution of Engineering and Technology | The Knowledge Network | Search IET Faraday

IET FARADAY

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WELCOME TO IET FARADAY

An exciting year-long programme of resources, activities, competitions and events designed to inspire young people about science, technology, engineering and maths (STEM).

With a new theme every year, the website contains a wealth of resources, including teaching materials for KS3, KS4 and Engineering Diploma, specially made films and games, which bring the real world of engineering to life.

More about us

CHALLENGE DAYS

Thank you to all schools that submitted a Challenge Day host school application. We received more than expected! Have a look at

TEACHERS RESOURCES

All the support material you need to use the IET Faraday themes in your own teaching environment.

Get the materials

MORE THEMES

minds into
.org/faraday

IET Faraday

aims of the materials

- To support the teaching of the secondary curriculum and to be closely aligned to the STEM agenda
- To allow the teacher to engage and 'own' the resources and consequently adapt them to their specific context and needs
- To allow a high level of flexibility and creativity when using the activities

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how were they designed?

- use ‘youth technologies’
- to be current and relevant
- use to real ‘engineers’
- bring new curriculum to life

- The current revision of the Key Stage 3 curriculum initiated by the Qualifications and Curriculum Authority holds the promise that the cross-curricular activity required by STEM will become the norm rather the exception. **D&T Association**

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youth technologies - youtube

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Transforming your lessons

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IET Faraday
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real engineers

IET Faraday
Transforming your lessons

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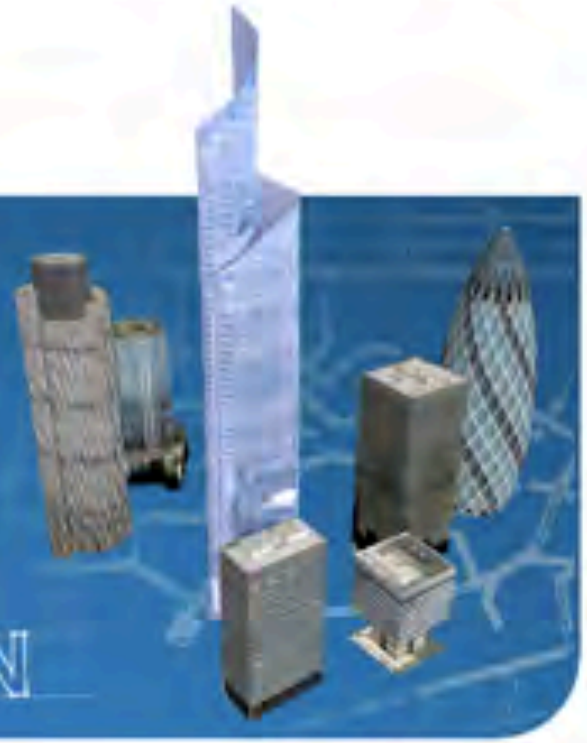
More about us

This year's theme looks at some of the most innovative structures we live amongst today, as well as what we might have in the future.

Explore

URBAN EVOLUTION



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MORE THEMES

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RESOURCES BY THEME

Materials (Urban Evolution)

Urban Evolution

Materials (Sport)

Real Stars of Sport

Materials (Health)

Technology for Life

Teacher Resources

Your role is to inspire your students about science, design and technology, engineering and maths (STEM). Ours is to make that task easier and more rewarding.

The award-winning IET Faraday is a free resource for teachers from The Institution of Engineering and Technology (IET). The programme provides an adaptable set of practical activities, based on designing, testing and developing to allow your students to apply knowledge and understanding in a meaningful way.

We know that science, engineering and technology are amazing, but encouraging students to realise this too can be challenging. Mapped to the curriculum and developed to complement your teaching, our materials will inspire your students with the real world application of these subjects.

Linking to the curriculum

Our free programme includes

1. Stimulating online materials, closely aligned to the STEM curricula, providing a structure for teachers in different departments to work collaboratively;
2. High quality support for KS3, GCSE and the Engineering Diploma (and equivalents);
3. Opportunities to link to ICT, Enterprise and Citizenship;
4. A wide range of worksheets for practical activities which can be creatively adapted to meet the needs of your classes.

POPULAR RESOURCES

Urban Evolution

KS3 Matrix Mapping
DOC 206 k | updated December 2009

Design and Technology (all files)
ZIP 19178 k | updated December 2009

Engineering Diploma (all files)
ZIP 6628 k | updated December 2009

Maths (all files)
ZIP 22727 k | updated December 2009

Science (all files)
ZIP 4570 k | updated December 2009

Real Stars of Sport

Aerodynamics in action
PDF 139 k | updated October 2008

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URBAN EVOLUTION

ENGINEERING STORIES ▽

TEACHING MATERIALS: DANCE POWER

These classroom activities look further into the scientific concepts and technologies behind the sustainable dance floor and relate directly to the Dance Power film.

They have been designed for mathematics, science and design and technology (D&T) lessons and are mapped to the new Secondary Curriculum and Personal Learning and Thinking Skills (PLTS) framework.

The activities clearly relate to one another and would best be used as part of a programme of study:

- 'Dancing is Electric' **(Maths Activity)**: A short but challenging activity in which students interpret and produce graphs modelling the energy produced on a sustainable dance floor.

MATERIALS:

Dance Power
Green School
Power House
Pure Water
Shifting Sewage
Sound Design

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Dancepower(all-files)

Name	Date Modified	Size
Curriculum-Mapping(UrbanEvolution).doc	17 December 2009 15:22	213 KB
Dance-is-Electric(Maths).doc	17 September 2009 17:25	1.4 MB
Dance-is-Electric(Maths).ppt	15 September 2009 14:38	1.3 MB
Overview-UrbanEvolution-Materials.doc	17 December 2009 15:28	352 KB
Power-of-Colour-1(D&T).ppt	15 September 2009 14:38	160 KB
Power-of-Colour-2(D&T).ppt	15 September 2009 14:38	193 KB
Power-of-Colour(D&T).doc	18 September 2009 11:28	188 KB
Psychology-of-Colour(Science).doc	15 September 2009 14:38	188 KB
Shocking-Truth(D&T).doc	15 September 2009 14:38	3.4 MB

9 items, 234.97 GB available

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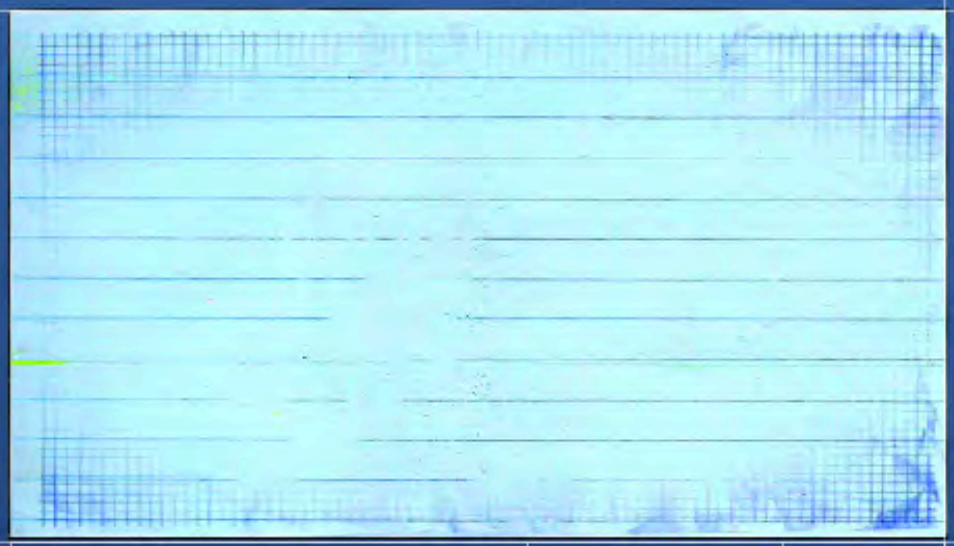
URBAN EVOLUTION

ENGINEERING STORIES ▽

THE STORY: DANCE POWER



PLAY: VOL: BIG:

THE ENGINEERING

Tile Prototypes

There is lot of energy coming from a crowd of clubbers when the music and environment are right. Why not harness that energy and use it to help power the lights?

THE TEAM

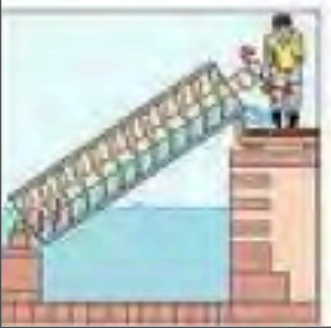
Dr Helm Jansen

Dr Johan Paulides

IET FARADAY

National Engineering Challenge day 2010

Urban dwellers adapt to global warming

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National Challenge Days

- 57 events across England, N Ireland, Scotland and Wales
- each have six teams (from six different local schools) of six Y8 students (3 girls, 3 boys where possible)
- 342 schools, 2,052 students per year

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context film

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Real engineering transforming your lessons

www.ietfaraday.org

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Context and engineering brief

- Over the past few years the UK has seen unprecedented flood levels across a range of urban areas
- Your team has been commissioned to design and make a prototype of a simple device, that will allow homeowners to remove water from their homes, during periods of flooding.

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challenge days

Real engineering transforming your lessons

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assessment

• Initial ideas	10 marks
• Development of ideas	20 marks
• Team accounting sheet	10 marks
• STEM questions	30 marks
• Team 'learning' video	30 marks
• Teamwork	10 marks
• The Challenge	90 marks

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teacher feedback

The Content of the Challenge Day	Strongly disagree	Disagree	Agree	Strongly agree
The level of complexity of content was suitable for aged 12-13 students	0	0	43	111
The Challenge Days were relevant to and supportive of, the national curriculum	0	0	67	97
The Challenge Days will encourage students to continue studying science, technology, engineering and maths related	0	1	39	113
The choice of presenters was suitable for the audience	0	0	25	141
The Challenge Day made careers in engineering, science and technology attractive to students	0	0	75	88
The Challenge Days are run for a full school day. This is the right length of time for the Challenge Day.	0	0	35	108

The Content of the Day - a selection of comments

Very good range of resources - excellent way of putting engineering into context. Task is definitely a challenge!
Good to have girls and boys involved and allow them a 'free' run to be creative.
Could do with 'handout' support materials (STEM careers) for the students.
A very enjoyable day. All students left enthused about science and engineering.
Excellent, really engaging for the level of pupils age and ability.
It would be nice if the Challenge Day could be run to come to all schools, or so we could bring more students, as I'd like this opportunity to be available to many more.
This run out of our school environment, by outside presenters was a perfect way to get over to students. The way this subject, career etc was better received and its far better that others got this accros to them.
An excellent day for all involved, really well organised and structured.
Excellent that an external agency comes in and takes the event. Far more successful with this being the case.
An absolutely brilliant day, I thouroughly enjoyed it - pupils had a great time. Highly recommended.
Gets students to work together as a team - develops PLTS skills
Look forward to examining the website and resources for teachers

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student feedback

Interest and Enjoyment

My thoughts on science, technology, engineering and maths subjects	Strongly disagree	Disagree	Agree	Strongly agree
The Challenge Days showed science, technology, engineering and maths as interesting subjects	2	45	550	373
I was inspired by the Challenge Day to take science, technology or engineering at GCSE	11	197	533	223
I would consider a career in engineering as a result of the Challenge Days	65	365	410	130
Before attending the Challenge Day I had considered pursuing a career in engineering	275	436	175	84

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Challenge Day Final 2009

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Challenge Day Final 2010

Scientific fun at the Big Bang

DO YOU know what the Big Bang is? You might have heard it was an almighty explosion of dense matter that marked the beginning of our universe but it's even more fun than that – it's also a science fair that celebrates great British design, engineering and technology.

This year's Big Bang took place in March and marked the end of a nationwide competition for schools, the IET Faraday Challenge. It is named after Michael Faraday, one of Britain's greatest scientists.

Finalists were asked to design and make a device that could be used by the earthquake-hit people of Haiti. The device was meant to enable Haitians to filter river water and make it safe to drink.

The teams were set the tough challenge with just six hours to complete it. They were given recyclable materials such as MDF, rubber and tubing, and a laptop with internet access. After some hard work, head-scratching and heartache, time was up and the winners were announced. An all-girl team from Victoria College in Belfast were clear champions and went home with a cheque for £1,000 and a bust of Michael Faraday. The girls loved the experience and a number of them were so inspired they are looking into careers in the field of design and technology.

If you're keen to find out more about working in innovation, go to www.theiet.org.

DESIGN INSPIRATION: The winning team from Victoria College, Belfast

MICHAEL FARADAY: Need 2 Know

- *He was born to a poor family in London in 1791*
- *He educated himself by reading books on science*
- *He discovered electromagnetic induction, the stuff that makes electric motors work*
- *His discoveries about electricity changed our world*
- *He was a great teacher and gave amazing lectures about science*

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- Mary Southall and Kevin Jones
- Thank you