Engineering Careers - working with school teachers to improve their knowledge of engineering and enhance their capacity to provide careers advice: a project with National Grid

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Abstract

This project was designed to enhance the capability of teachers to provide relevant and accurate advice about engineering careers in collaboration with National Grid. A newly developed continuing professional development session was delivered to 52 science and technology teachers to enhance their knowledge and confidence with regard to offering advice and guidance to pupils and fellow colleagues. The approach, facilitated with input from higher education institution academics, Science Learning Centre South East staff and National Grid engineers, has been shown to be effective in enhancing teachers’ knowledge of careers in engineering and in enabling them to subsequently provide advice and information to students. Reported impact includes enrichment of lesson plans and schemes of work within delegates’ schools, including engineering career-specific advice resulting in more effective communication about engineering careers. Teachers now have the confidence to offer specific advice to under-represented groups such as females and pupils from Black and Minority Ethnic communities in order to widen participation within engineering.

Keywords: engineering, careers, lesson, schemes of work, energy, advice, guidance, participation.

Background

The project delivered a continuing professional development (CPD) session to 34 teachers of science/technology which focused on engineering careers at a university-based Science Learning Centre (SLC) and a National Grid facility. The session combined innovative approaches to the teaching of electricity and power generation at key stage 4, including careers-linked content. The aim was to ensure that teachers in schools were better informed of the opportunities and possible qualification pathways for students thinking of entering engineering careers. By highlighting activities undertaken by engineers daily within National Grid operations and engineering occupations throughout the UK, the teachers would be better placed to encourage students to make informed choices about degree studies and career aspirations.

The SLCs have long utilised their established expertise and credibility in providing professional development for teachers. Input from the Science Learning Centre South East (SLCSE) was vital in terms of being the most effective route to achieving the project’s aim and providing a mechanism whereby a resultant model could be transferred to other regions through other SLCs. Higher education institution (HEI) academics and National Grid representatives (as the employer partner) also took part in the training days and reinforced this aim. They were able to speak with authority to teachers, many of whom were from a non-engineering background, about engineering and engineering qualifications.
A best practice guide outlining the design, delivery and outcomes of the project is currently being produced by the SLCSE. This will be made available via the HE STEM Programme website.

**Rationale**

In the 2009 report *Engineering our future: inspiring and attracting tomorrow’s engineers*, National Grid highlighted that engineering careers information available to school students through teachers was poor, a finding also mirrored by a recent OFSTED report (2011); therefore it was difficult for school students to make informed choices. Young people, their teachers, parents and advisers’ perceptions of engineering were also investigated and found to be prejudiced in nature. Many considered it to be ‘menial’ or ‘blue collar’, ‘a dying industry’ and ‘for men and not women’ (a view expressed by Black and Minority Ethnic parents in particular). These prejudices give rise to behaviours that are detrimental to engineering in general and reduce the likelihood of teachers and parents recommending such degree or career pathways. *Engineering our future* highlighted the fact that ‘we need to raise awareness and shift perceptions. Specific interventions are required to create exposure to engineering and stimulate the interest of young people and the teachers and parents who advise them’ (National Grid, 2009).

Students are known to possess limited knowledge of opportunities in and from engineering. Improved information would persuade more of them to consider engineering as a viable option for future employment (*ibid*). The UK is failing to keep pace with the world demand for engineers and the “traditional” view of engineering and the source of engineers needs to be countered (The Royal Academy of Engineering, 2009). Teachers are a particularly influential factor in terms of providing careers information; on average the majority are asked about careers information once a term by teaching colleagues and are more likely to be asked once a week by pupils (Engineering UK, 2011). It is also important that teachers incorporate careers information into mainstream science, technology, engineering and mathematics (STEM) teaching from key stage 3. 70% of teachers agreed that CPD would make them feel more enthusiastic about offering careers information and advice and 91% said it would be easier if there was a single online resource for STEM careers information (*ibid*).

It is also economically vital to remove barriers in the way of women who would like to take up occupations perceived to be male-oriented. The value to the UK economy of attracting females into engineering could be as much as £15-23 billion, or 1.3-2.0% of gross domestic product (Kiwana et al., 2011). Furthermore, careers information, advice and guidance are still reinforcing stereotypes (*ibid*). Students from under-represented groups may be inspired to become engineers but are not able to access the same support in applying to university as students from “traditional” backgrounds. For example, the quality of advice from teachers in schools where there is little experience of students going to university will be limited. Evaluation in this report reveals that only one-third of the teachers who attended the CPD training had an engineering background.

National Grid is a key employer in engineering and provides careers and employment for thousands of people in the UK at all levels, from apprentice to postgraduate. Roles within the National Grid include those within technical areas, productivity, commerce, human resources, planning, procurement, finance, systems analysis and IT. National Grid is therefore interested in working with the teaching and careers advisory staff that have a vital role in dissemination of these employment options to students, ensuring that they understand the benefits of an engineering career and the routes to becoming an engineer and providing them with accurate and contemporary careers advice to guide their future choices. The National Grid also needs STEM-skilled people at all levels, from apprentice to postgraduate. 25 million homes, almost 5 million businesses and 1,000 hospitals are connected to the Grid, which itself is supplied by almost 150 connected power stations. Maintaining and developing the network and ensuring that it is supplied is the task of engineers. Many teachers are unaware of the scale of this activity, even though the curriculum specifies power generation as an area of learning. Helping teachers to understand how National Grid operates and the routes to becoming an engineer will contribute to attracting students into engineering careers.
The approach

Representatives from National Grid, SLCSE, the National HE STEM Programme and The Royal Academy of Engineering formed a planning committee and met three times to discuss development and design of a one-day CPD episode.

Project delivery was divided into a number of set deliverable activities.

**Phase 1**

The SLCSE is one of nine regional Centres which are part of the national network of SLCs funded by the Department for Education. The remit of the network is to design, develop and deliver CPD in science education. SLCSE was commissioned to design, develop and pilot a one-day CPD episode for teachers. A key feature of the design was to include inputs from National Grid staff with engineering experience and HEI academics from engineering disciplines. It was important to include approaches to the teaching of power generation as well as information on careers in order to maximise the attractiveness of the course to teachers. This resulted in excellent recruitment to the course. The course was delivered by SLCSE staff, consultant educators, HEI academics and professional engineers from the National Grid. Delivery took place at the University of Southampton and the National Grid control centre at Wokingham in Berkshire. Both venues offered facilities which placed the sessions in “real” engineering contexts.

The project team determined the course content, which included:

- information on careers in engineering, illustrated by contemporary examples exemplifying the range and variety of careers and how to access further information
- the content of modern engineering courses at HEIs, including direct access to examples of current research and employment activities
- an overview of life at university (particularly pertinent to those who are the first in the family or school to study engineering at university)
- best practice in advising students on applying for engineering courses at HEIs (the components of a good UCAS application, HEI requirements of applicants)
- additional opportunities for potential engineering students, including sponsorship (e.g. Power Academy), work placements, Year in Industry and other development schemes
- best practice in encouraging under-represented groups into engineering by targeting each audience segment with an appropriate message set
- advice on working with parents to reassure them of the value to their children of an engineering qualification
- how to access local professional engineers to support careers or other activities in school (e.g. STEMNET Ambassadors)
- the potential of STEM qualifications as a route to starting a business
- teaching approaches to power generation, including practical demonstrations which exemplified aspects of the operation of National Grid
- a visit to a relevant science facility. This was the High Voltage Laboratory at Southampton and the National Grid control facilities at Wokingham.

**Phase 2**

Supporting resources were designed and developed to be used as part of the professional development and loaded onto memory sticks to be taken away by participants. This helped to increase the impact and reach of the professional development by dissemination to colleagues in school. The resources included:

- materials for HEI academics and delivery consultants to use to support delivery of the CPD course, including presentation materials and practical activities
- materials to be given to participating teachers/schools for use in the classroom, including posters, videos for display in schools and case studies. All participants were provided with a copy of the book *Sustainable Energy without the Hot Air* by David Mackay. A section of high voltage power cable was also given to teachers/advisers to use in careers/science sessions in school.

**Phase 3**

Piloting of the course took place at two events: SLCSE at the University of Southampton and the National Grid facility at Wokingham. The course was free to attend and teachers were given a £200 bursary (this is based on the SLCs’ *Impact Award*) which helped to cover the cost of supply cover and thereby enabled them to attend. Teachers were provided with laptops throughout the day and all resources were on a memory stick. This enabled them to access the resources as they were being used and to personalise and customise them to meet their own needs. The course was evaluated at the end of the day using the SLC network standard evaluation. The SLC impact process was used to help enhance the impact of the CPD. This required teachers to:

- consider their intended learning outcomes before the course and discuss the potential impact with their line manager
- carry out action planning during the course, setting out how they will implement learning back in school or college
- between six weeks and six months after the course, return data on the impact of professional development (to allow for impact to be demonstrated).

Following the delivery of the two episodes, an evaluation meeting between the HE STEM Programme and SLCSE project leads took place and recommended the following revisions:

- Introduce data activities during the morning session in order to enhance the interactive elements of the course
- Include additional input from a HEI representative on enhancing personal statements and applications for engineering courses; teachers are often involved in guiding their students during applications
- Include references to further engineering-related resources.

The revised course was delivered to a further group of 20 teacher delegates. Again, this course was oversubscribed.

**Phase 4**

Dissemination and roll-out.

Following successful piloting, the project is to be disseminated via the following routes:

- SLCSE will run three further instances of the course (one per term) in 2012/13. Further impact data will be gathered, particularly from a longer-term perspective to explore longer-term effects of the professional development
- SLCSE will work with two of its partner Centres to roll the project out across England. In the first instance, the Centres in the East Midlands and Yorkshire and Humber (due to their proximity to National Grid facilities) will be offered the opportunity to deliver the project in their own region. This approach will test the transferability of the project and establish best practice for sharing of the resources. Following successful piloting with these two Centres, the best approach for offering the course to the network will be determined
- The project is to be presented at engineering and STEM-focused seminars/conferences.
Evaluation

Evaluation of courses

The professional development days were designed to train 20 delegates per instance. Recruitment for the events was very good, with both being oversubscribed within several weeks. There were 34 attendees in total at the two initial events and 18 at the extension event. Initial evaluation, using SLCSE standard evaluation processes and including a breakdown of the delegate cohort, is shown in Table 1.

Table 1. Evaluative feedback from the three SLC Careers Day Teacher CPD events at Southampton SLC/Tony Davis High Voltage Laboratory, University of Southampton and the National Grid Control Centre, Wokingham (supplied by SLC)

<table>
<thead>
<tr>
<th>Course date and location</th>
<th>Delegate breakdown</th>
<th>Overall quality of course (% indicating “very good” or “good”)</th>
<th>Extent to which course outcomes were met (% indicating “fully” or “mostly”)</th>
<th>Usefulness to practice (% indicating “very good” or “good”)</th>
<th>Personal interest/enjoyment (% indicating “very good” or “good”)</th>
<th>Would you recommend this course to others? (% indicating “yes”)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 December 2011, Southampton</td>
<td>16 teachers 1 technician 1 GTP trainee</td>
<td>100% (18/18)</td>
<td>100% (18/18)</td>
<td>100% (18/18)</td>
<td>100% (18/18)</td>
<td>100% (18/18)</td>
</tr>
<tr>
<td>10 December 2011, Wokingham</td>
<td>15 teachers 1 trainee</td>
<td>100% (16/16)</td>
<td>100% (16/16)</td>
<td>100% (16/16)</td>
<td>100% (16/16)</td>
<td>100% (16/16)</td>
</tr>
<tr>
<td>20 March 2012, Southampton</td>
<td>15 teachers 2 technicians 1 teaching assistant</td>
<td>94.4% (17/18)</td>
<td>94.4% (17/18)</td>
<td>94.4% (17/18)</td>
<td>100% (18/18)</td>
<td>94.4% (17/18)</td>
</tr>
</tbody>
</table>

1 The participant who gave a satisfactory evaluation was a technician accompanying a teacher. This is regarded as useful, as evidence shows that teachers are more likely to implement learning if supported by a technician back at school, but may explain the lower rating as the course was primarily designed for teachers.

Key findings of the evaluation

In the free-text entry section of the evaluation, the following key issues were highlighted:

- Teachers greatly enjoyed the day and found value in all activities
- The representation from National Grid was important, as was the chance to ask questions of practising engineers
- The SLCSE staff were considered knowledgeable and approachable
- The data exercises (looking at demand/supply) were well-received and would be used back in the classroom
- The visits (to both the High Voltage Laboratory and National Grid facilities at Wokingham) were regarded as valuable
- The resources provided on the memory stick were popular and many teachers indicated that they would be used in school or college. Being able to use and customise the resources during the sessions was both novel and useful. The book was also well received.

Below is a selection of the positive comments concerning the event and resources:

- ‘Loved it - all useful - I enjoyed the model oven and “induction cooker” experiment - really relevant to my students. Fantastic being at the actual National Grid’
- ‘Careers to bring new, inspiring jobs to girls’
- ‘Presenters had great interaction with each other, sharing expertise and knowledge. Great to have a representative from the National Grid’
- ‘Excellent on all counts (presenters). I found it particularly good to have a combination of National Grid employees and SLC employees’
- ‘Made me think about recording electricity used by school and using graphs generated to inform discussion, also to change behaviour’
- ‘The opportunity to talk to professionals about their work and profession’
- ‘Excellent ideas for discussion and practicals in lessons. Very relevant. Excellent resources’
- ‘Learning the work ethos of the National Grid and the opportunities for careers in engineering’
- ‘Tangible things which I can use immediately’
- ‘Practical demonstration of power supply’
- ‘Ideas of National Grid and sustainable options for future. What a great idea to provide pen drives’.

An assessment of the project-specific and medium-term impacts of the training and resource provision was carried out. A web-based survey was designed and commissioned several weeks after the two CPD events. The aim was to solicit specific information regarding the delegates’ backgrounds, use of the resources to date, how the delegates felt their confidence in the subject matter had improved or otherwise and delegates’ plans to disseminate the information, both to students and colleagues. Table 2 shows that 18 of the 34 delegates responded.

**Table 2. Web-based survey responses from the two SLC Careers Day Teacher CPD events at Southampton SLC/Tony Davis High Voltage Laboratory, University of Southampton and the National Grid Control Centre, Wokingham**

<table>
<thead>
<tr>
<th>Do you have an engineering background? If yes, please define (e.g. civil, mechanical, BEng, MEng, industry experience, etc.)</th>
<th>How confident do you now feel in giving specific engineering careers advice to pupils and colleagues?</th>
<th>How confident do you now feel in knowing where to find relevant resources to support your advice?</th>
<th>How useful will you find the information/knowledge gained from the Engineering Careers event when promoting engineering careers to under-represented groups such as females and Black and Minority Ethnic pupils?</th>
<th>How confident do you now feel about your knowledge of the entry requirements for vocational routes to engineering careers (e.g. apprenticeships)?</th>
<th>How confident do you now feel about your knowledge of the entry requirements for further education level routes to engineering careers?</th>
<th>How confident do you now feel about your knowledge of the entry requirements for higher education level routes to engineering careers (UCAS criteria)?</th>
</tr>
</thead>
<tbody>
<tr>
<td>33% Yes 66% No</td>
<td>78% Confident or very confident</td>
<td>94% Useful or very useful</td>
<td>78% Confident or very confident</td>
<td>65% Confident or very confident</td>
<td>61% Confident or very confident</td>
<td>61% Confident or very confident</td>
</tr>
</tbody>
</table>

From the responses given, teachers with an engineering background had gained experience from areas such as HM Forces and communications, mechanical and electrical engineering; however, it can be seen that only one-third had some degree of engineering experience.

Evaluation of the resources given to the delegates on leaving the event and use of the knowledge gained within the training was particularly encouraging. Within a very short time frame of a few weeks, 78% of the respondents had used the resources to disseminate information to pupils and colleagues.

Table 3 shows how the information and knowledge from the day has been or is planned to be used.

**Table 3. Responses of the delegates of the two SLC Careers Day Teacher CPD events regarding how they have and plan to utilise the knowledge and resource received at the events**
<table>
<thead>
<tr>
<th>Have you used the information/knowledge gained during the Engineering Careers event?</th>
<th>How have you used this knowledge?</th>
<th>How do you plan to use this knowledge in the future?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>I have used some of the ideas whilst teaching Year 10 about transmission of electricity. The sample of transmission cable came in very handy and prompted good discussions with the group</td>
<td>To write new ideas into the scheme of work and to share the ideas gained with other colleagues in the science department</td>
</tr>
<tr>
<td>Yes</td>
<td>Adding to existing lesson plans, preparing section on engineering for other teachers in department</td>
<td>Ensure all teachers have same level of knowledge both inside and outside the science department</td>
</tr>
<tr>
<td>Yes</td>
<td>I have planned an assembly and a series of tutor time activities for key stage 4 on engineering as a career. I have also planned the National Grid AQA (awarding body) lessons for our Year 9 key stage 3-4 transition programme</td>
<td>Continue to implement the ideas in lessons and feed back to pupils my knowledge of engineering as a career</td>
</tr>
<tr>
<td>Yes</td>
<td>By talking to our school careers officer</td>
<td>Talking to pupils who are interested in taking design and technology as a G.C.S.E. subject</td>
</tr>
<tr>
<td>Yes</td>
<td>Advising students at college careers evenings</td>
<td>Giving advice to students applying for FE courses</td>
</tr>
<tr>
<td>No</td>
<td>I answered no</td>
<td>When discussing with pupils, most probably in informal conversations</td>
</tr>
<tr>
<td>Yes</td>
<td>Used information to discuss applications of engineering. Discussed career pathways. Talked about importance of UK engineering versus the world historically and in the present</td>
<td>Continue to encourage our young folk to follow an engineering route</td>
</tr>
<tr>
<td>Yes</td>
<td>Advising pupils who may not be candidates for top university courses about apprenticeships</td>
<td>Similarly</td>
</tr>
<tr>
<td>Yes</td>
<td>Advised final-year students on careers available and importance of clear, concise CVs and covering letters that match job/apprenticeship advertisements</td>
<td>Much the same: to advise final-year students on careers available and importance of clear, concise CVs and covering letters that match job/apprenticeship advertisements</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Not yet had a chance to use it</td>
<td>Yes - I plan to use the knowledge gained when teaching. I have not yet used it as I am not currently teaching the relevant course but will before the end of this year</td>
</tr>
<tr>
<td>Yes</td>
<td>Have shown everyone in dept. the pylon wire which was very well received and incited lots of discussion about design</td>
<td>Feeding back to dept. at next faculty meeting, will integrate resources into the key stage 3 and 4 schemes of work</td>
</tr>
<tr>
<td>Yes</td>
<td>Disseminating resources to colleagues</td>
<td>Discuss career opportunities in engineering with my students</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>I have discussed engineering as an option with six form students as well as year 11 [level 1] who are thinking about choices for next year at the moment. I have also discussed the ideas with year 10 girls</td>
<td>I am organising a workshop for year 12 [level 2] along with the STEM Ambassadors from Reading University</td>
</tr>
<tr>
<td>Yes</td>
<td>I'm currently teaching electricity so it was great to talk about the visit to the National Grid and show students the power cable to interest them. We also talked about how they could be the ones to solve the energy crisis in the future</td>
<td>Try some of the practical activities with my students; embed what I learnt in my planning for next term. I've also been researching careers on the National Grid website and looking at routes of entry into engineering</td>
</tr>
<tr>
<td>Yes</td>
<td>I have planned a series of lessons to teach to key stage 4 based around the content covered on the training day. I have also included a section on careers in science that involve physics and maths</td>
<td>I plan to try and bring this information down into our key stage 3 curriculum</td>
</tr>
<tr>
<td>Yes</td>
<td>Advising 6th form [levels 2 and 3] mentees</td>
<td>Directing A-level students to appropriate resources/opportunities</td>
</tr>
</tbody>
</table>

N.B. Those statements that indicate a rapid impact are highlighted.
The comments in Table 3 indicate that the resources and information already and potentially have a great deal of impact when considered against the project aims. Individual pupils and department colleagues have benefited from the acquired knowledge. Furthermore, future lesson plans and schemes of work at key stages 3 and 4 are being updated to include aspects of the CPD training. Further longer-term assessment of impact is being gathered by SLCSE and will be made available later this year.

**Discussion, summary**

This is an innovative approach to professional development relating to careers in engineering in that it brings together practising engineers from industry (National Grid), HEI academics and experienced professional development trainers. Combining this expertise brings an authenticity to the experience and offers teachers the opportunity to access a range of resources about careers. The sessions included visits to “real” facilities which enhanced the experience for those attending. The evaluations showed that teachers valued all aspects of the courses and SLCSE will be observing a sample of teachers to assess longer-term impact.

The courses ran alongside the SLC’s regular programme. The courses were free to attend and teachers could claim a £200 bursary to contribute to the cost of supply cover, enabling them to be released to attend.

Initially, two courses scheduled for June 2011 failed to recruit sufficient numbers, most likely due to a combination of the difficulty of teachers being released from school and recruitment material that were somewhat “dry”. The latter was revised to appeal to teachers and courses were rescheduled for December 2011, at a time when teachers are not usually involved in preparation for examinations or other activities which might prevent them from gaining release from school. The Saturday option was included to ensure that the difficulties of release from school would not prevent the course from running at all. In the event, both courses recruited.

In order to increase capacity, SLCSE has since decided to employ a co-presenter (an external consultant) who has worked closely with the Centre and has experience in delivering a similar programme.

The approach has proved to be highly successful in bringing professional development to teachers in terms of engineering careers. Part of its success results from careers information being put into the context of teaching resources linked to the operation of National Grid; the combination of innovative resources, including fascinating facts and figures on power generation, appealed to teachers and helped to put the whole area into a relevant context.

The project has been included in the following resources:

- **HE STEM Programme** *Creative Learning Journeys* video resource: *Creative Learning Journeys* project staff attended the course on 20 March 2012 to film and conduct interviews for inclusion in its output


- London and South East region HE STEM programme website: [http://www.southampton.ac.uk/hestem/](http://www.southampton.ac.uk/hestem/)

- HE STEM Programme London and South East Regional Spoke: dissemination brochures will be sent to Spoke mailing list addresses and outreach teams across the region

- The project will be taking a lead position in a conference on *Engaging with Engineering*. The audience will include head teachers/department heads, engineering Regional Action Plan projects, regional engineering small-to-medium-sized-enterprises and national engineering companies

- The project will be showcased as a case studies/good practice guide that the Public Engagement and Widening Participation Special Interest Group (PEWP SIG) are producing for
the National HE STEM Programme Conference in September 2012. This will also highlight the project and disseminate it further to a national audience.

Further development

Impact evaluation of the project (and the professional development course in particular) will continue as teacher delegates return their Impact of professional development (IPD) forms to SLCSE. This will be reported later in the year.

Going forward, National Grid is keen to support further events and is also exploring the methods used to approach teacher/pupil interaction. SLCSE is using the project to involve further corporate organisations and is also using the model to explore other areas of science careers professional development, including the polymer industry. The Director of the Centre is in discussion with the Network’s Director of Programmes regarding the possibility of including the professional development in the SLC Network core programme.

If future events are to be undertaken by this project team, or by teams at other institutions, it is recommended that consideration be given to the following developmental points:

- The inclusion of specific advice concerning HEI admissions. This could include advice on applications to HEIs, for example personal statements. Common errors or omissions could be addressed so that teachers can assist pupils with a more refined and targeted UCAS application
- Those undertaking similar careers advisory activities may well consider it appropriate to include diversity experts such as the UK Resource Centre (UKRC) in the forward design committee.
- A Sharing of best practice in teaching session could be included, thereby drawing on the pedagogical expertise of practising teachers
- Course delivery staff may consider inviting a previous delegate back to discuss how they have used the approach in the classroom
- The session should include some degree of signposting to resources that teachers can utilise within careers and science lessons. These resources can be used to target specific areas or under-represented groups. Examples could include:
  - Links to the National STEM Centre (http://www.nationalstemcentre.org.uk/). The National STEM Centre in York is collating the largest collection of resources for teachers of STEM subjects in the UK
  - The Royal Academy of Engineering education links (http://www.raeng.org.uk/education/usefullinks.htm). The site has useful links to educational and careers resources
  - Engineer Girl website (http://www.engineergirl.org/). A US site dedicated to the advancement of girls into engineering disciplines
  - National Grid education website (http://www.nationalgrideducation.com/)
  - Organisations whose aim it is to shape education and act as an interface between business and education when promoting change. Examples include the Ellen MacArthur Foundation (http://www.ellenmacarthurfoundation.org/)
  - Funding organisations that support high ability pupils, such as the Engineering Development Trust (http://www.etrust.org.uk/), Arkwright Scholarships (http://www.arkwright.org.uk/) and Happold Trust (http://www.happoldtrust.org/)
  - Previous project resources such as case studies and usable facts. The Royal Academy of Engineering London Engineering Project (LEP) specifically targeted widening participation in terms of girls, students with no family history of higher education, Black and Minority Ethnic students and adult learners. The LEP website hosts a wide selection of resources, including case studies and interesting facts that can be used by teachers to engage pupils in discussion (http://www.thelеп.org.uk/home)
This list is not exhaustive and individual evaluation of each event will guide future development. True impact can only be considered within the fullness of time. With such an approach it is hoped that those from under-represented groups can aspire to and gain places within the much-needed UK engineering workforce.

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**Further reading/bibliography**


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