Capability for Engineering — the Engineering Education Scheme

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The Engineering Education Scheme sets out 'to encourage more of the most able A level students to take up Engineering as a career'. It provides a structure within which a team of four to six students can tackle an actual engineering problem for, and with, an industrial company in their locality. Additionally, participants sample for a week the life of engineering undergraduates in a university. Supported by the Gatsby Charitable Foundation (one of the Sainsbury family trusts) the scheme has grown over nine years to accommodate around a hundred teams each year.

As these experiences take place in the lower sixth form, the students involved use their new knowledge of the opportunities offered by careers in engineering to inform their choice of university or polytechnic course. Their enhanced awareness reaches a wide audience, both through informal contact with friends, classmates, parents and teachers, and through formal presentations or assemblies at school or college.

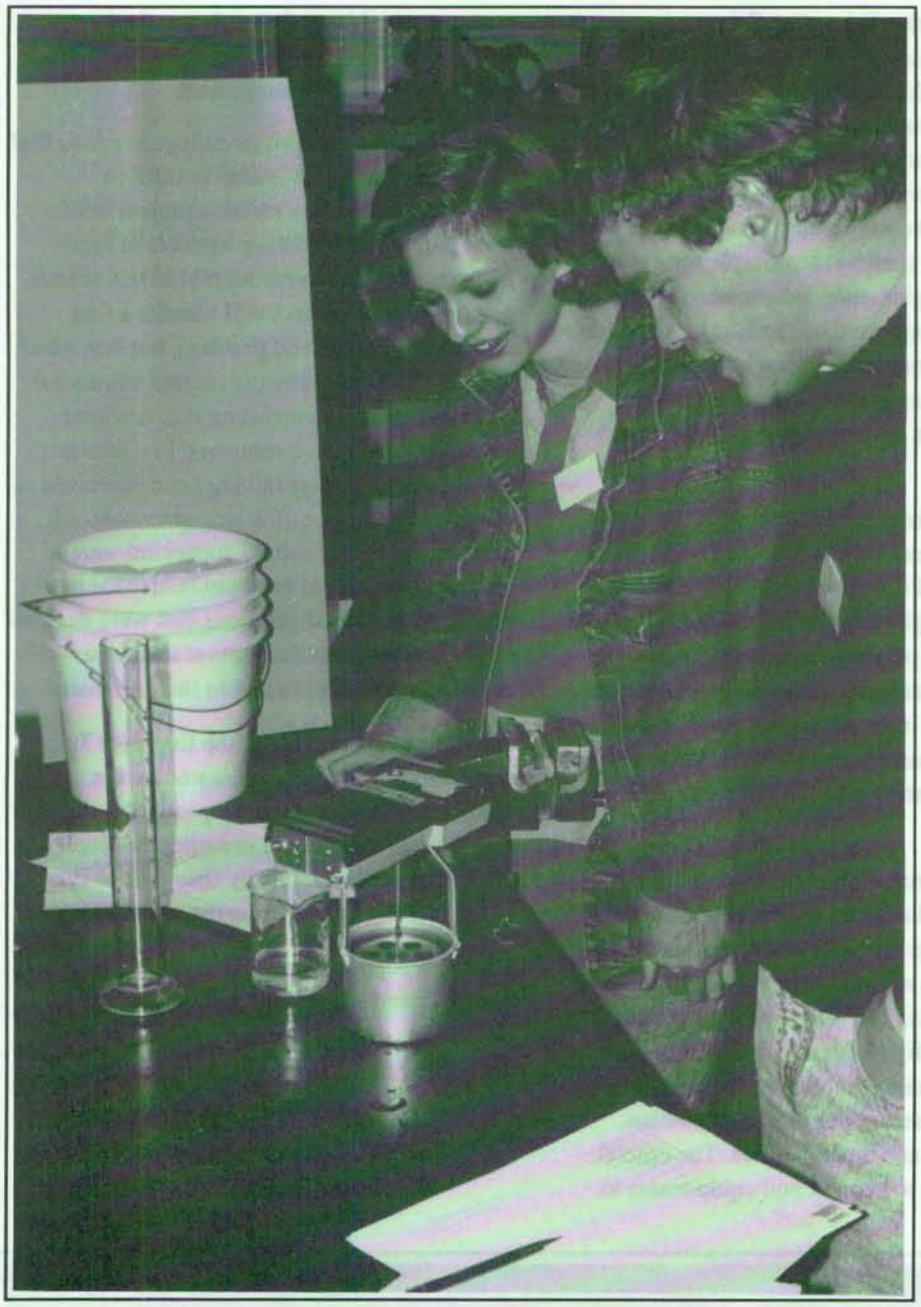
An 'Engineering Tutor' from the partner company and a 'Support Teacher' from the school/college work together to ensure that students gain as much as possible from the project. Having fulfilled the latter role for three teams, I still find it hard to define. I have acted variously as moral supporter, listener, 'chivvier', teacher, dogsbody, technician, driver, liaser and much besides. The crucial aim has been to support and equip teams to overcome problems themselves, whether they concern engineering, relationships, communication or management.

To participate, a school or college needs to find a local company that is able to offer an Engineer Tutor and a suitable project brief. Both parents and existing contacts in local industry can prove very helpful in this search. An appropriate project will address a real, rather than a contrived problem, but one which is not so commercially urgent that a financial risk is incurred by entrusting it to novices; typically, it will have remained low on a task list for a while, never having been perceived as urgent enough to be allocated resources. All three of the projects that I supported were of this nature, but I am proud to relate that two of the teams produced solutions that were deemed viable by the industrial partner and were subsequently incorporated in their product.

Albeit in the background, the Engineer Tutor and Support Teacher (nominated by the company and the school, respectively) will play an essential role in ensuring the quality of student experience. Ideally they will be central in negotiating and refining the project brief.

Different support tutors bring different strengths and approaches to the job. My experience of supporting A Level Design and Technology projects proved invaluable as did specialist support from colleagues in other departments.

Left to right: Andy Spence, Sian Bevane, Stephen Hedge and Nicola Hardy, Long Road Sixth Form College, Cambridge.



Calibrating test solutions for viscosity.
Left to Right: Karen England and Mark Hayley.

Team selection in concurrent with project selection. Applicants must be studying for A Level Mathematics to ensure their viability as candidates for engineering degree courses, but they need not necessarily see themselves as potential engineers at this stage. One aim of the scheme is to invite, for example, potential accountants, to 'taste' engineering before making UCCA choices.

The school or college and partner company jointly select students, by written application and a demanding interview. (A successful team will be one that is able to draw on a range of technical skills and personal qualities.)

The project phase

At the earliest opportunity each team visits its industrial partner for an insight into the company and a project briefing.

Scheme Induction Day is a regional conference of teams and tutors, at which students are briefed in more detail about the scheme and their own projects; seminars on project management prepare teams to produce work schedules.

During the subsequent 4-6 weeks of **'Work in Progress'** each team meets regularly in extracurricular time. The venue may be school or college, or the company premises, but both the engineering tutor and the support teacher offer frequent contact and support.

The 4-day **Residential Workshop,** normally held at Loughborough University of Technology, involves intensive practical work, exploiting specialist equipment and expertise not normally available to A level students. Experimenting, using CAD, machining and assembly are common activities. The social opportunities offered by the workshop are well exploited!

During the second period of **Work in Progress** students complete and test their chosen solution, produce a formal report using DTP facilities at school/college and prepare their presentation. The latter involves planning and rehearsing on video a 15 minute formal presentation, together with a shortened informal version; a mobile display must also be prepared to explain and promote their chosen solution.

On **Regional Presentation and Assessment Day** teams arrive early to erect displays and test equipment. Assessment panels comprise engineers from industry, professional institutions and universities ('new' and 'old') together with representatives from LEAs and tertiary education. Each team gives a 15 minute audio-visual presentation to the assessors, and is then questioned at the display for 30 minutes. There are 12 assessment criteria, and teams are debriefed on their performance not only in addressing the problem, but in organising themselves, working as a team and presenting their work. Later each team gives a less formal, 5 minute presentation to a wider invited audience and certificates are presented.

Project examples

The teams which I supported:

- produced a prototype low cost laser modulator, using a small loudspeaker to drive a shutter across the laser beam (with LaserScan Laboratories, Cambridge);
- re-production-engineered a falling ball viscometer, halving assembly time and reducing component costs (with Domino Aujet, Bar Hill);
- redesigned a magnetic stirrer and designed a motor driver circuit which prevented decoupling for a very dense pigmented ink (also with Domino Aujet).

The latter two solutions had to function within inkjet printers, and were subjected to pressurised volatile solvents and, in one case, a highly abrasive pigment. The students, although novices, were therefore designing within quite challenging constraints.

Examples of 1991–92 projects listed by the EES give an indication of the variety of problems addressed under the scheme:

Yorkie bar lane changer
Leak testing of plastic closures
Intelligent gauging jig sensors
A washing system for solder printing masks
Optimal design for a four–way pallet
Automatic bleed device (for aircraft hydraulics)
Thermal spray powder saving system
Handling edible inclusions into ice-cream streams
Safety brake for bandsaws
Improved filling system for high–viscosity fluids
Retrofit of domestic freezer using KLEA 134a and investigation of subsequent energy consumption
Find a method for recognising different defect types in float glass
Determining automatically the length of cut sheets of paper

The higher education phase

Towards the end of the academic year students attend one of the 'taster' weeks provided by a dozen or so universities and polytechnics specifically for the EES. Here they experience typical lectures, practicals and visits, giving insight into the various branches of engineering. Career paths are also explained.

The Sainsbury Engineering Education Continuum

The EES is only part of an extended programme. Other phases are the pre–university **'Year in Industry'** scheme which offers one year industrial placements; the **'University Programme'** under which engineering undergraduates can compete for financial support, and/or for bursaries for special projects: and the **MBA scheme** which supports selected postgraduates.

Benefits

Below are some of the outcomes that I observed at Long Road Sixth Form College:

- students who took part flourished in numerous ways, most noticeably in their competence as communicators: (to quote an assessor 'I wish that my professional engineers could communicate half as effectively');
- Design and Technology gained a higher profile within the college;
- the message that both male and female lower sixth formers can be highly competent in the engineering domain has been spread within the college and through regional television coverage, throughout the region;
- both students and teachers have gained insights into industry;
- the college gained some very committed friends within local industry who have proved helpful as project consultants outside the EES, and generous with resources;
- several students obtained summer jobs doing research for a partner company;
- a number of students have enrolled on engineering degrees;
- a great deal of fun has been had amidst the expenditure of considerable effort!

Further information

I must emphasise that I am an enthusiast for the EES, not a representative.

For further details please contact: Linda J Scott, Director, The Engineering Education Scheme, Astwick Manor, Coopers Green Lane, Hatfield, HERTS AL10 9BD.