



## **Ofsted Subject Conference Report: Design & Technology**

**Title:** GCSE Engineering in schools

**Venue:** Institution of Electrical Engineers, London

**Date:** 22 June, 2004

### **Speakers:**

- Peter Toft HMI, Specialist Subject Adviser for design & technology
- John Mattick HMI
- Paul Sardar, Vice Principal ADT College
- Professor Geoffrey Harrison, Consultant Researcher, Qualifications and Curriculum Authority (QCA)

### **Synopsis**

The conference focused on improving teaching and learning in the vocational GCSE Engineering course which was introduced in September 2002. Sessions included:

- reviews of strengths and weaknesses in the course revealed by inspection including:
  - standards of achievement
  - effectiveness of teaching, curriculum and assessment
  - staffing
  - securing resources and accommodation
  - support for development
- a review of the extent to which the course reflects the breadth of the engineering industry
- consideration of ways to strengthen the course and ensure that it gives pupils a clear insight into modern engineering practice.

Delegates were invited from a wide range of policy, management and support positions in government, education and industry. They had the opportunity to discuss, drawing on their own experience ways of helping schools to develop excellence within this course. Delegates were invited to disseminate conference findings as appropriate within their own organisations.

## Target Audience

- (1) Representatives of the engineering industry.
- (2) Representatives of Government, its agencies and the awarding bodies which oversee this course.
- (3) Individuals and organisations providing support to schools for the course.
- (4) Senior teachers of engineering in schools.

Fifty-one delegates attended, representing: Ofsted; DfES; QCA; the three GCSE awarding bodies; six secondary schools; the Design and Technology Association (DATA); three universities; the Engineering Council; the Institution of Electrical Engineers; Nuffield Foundation; the Technology Enhancement Programme; the Royal Academy of Engineering; the Occupational Standards Council for Engineering; the Sector Skills Council for Science; Engineering and Manufacturing Technologies (SEMTA); The Engineering & Technology Board; The Engineering Employers' Federation; Young Engineers; The Science, Engineering, Technology and Mathematics Network (SETNET); the Specialist Schools Trust; the National Association of Advisers & Inspectors for D&T; Nortel Networks and Thales plc; and The Times Education Supplement.

## Summaries of conference sessions

### ***Implementing GCSE Engineering in schools: the first two years*** ***Peter Toft HMI and John Mattick HMI***

HMI evaluation reveals that:

- the Engineering GCSE course has got off to a reasonably good start and is popular with the pupils who study it
- standards in the lessons seen:
  - were sound or better in making, reading and producing engineering drawings, and pupils' understanding of aspects of the engineering industry
  - were less well developed in designing and in the use of modern technologies than they are in established design and technology courses
- the craft and technician levels of engineering were well represented in courses but coverage of the professional dimension was relatively weak
- issues needing resolution include:
  - challenging pupils of all abilities
  - training teachers to teach modern engineering effectively
  - improving the vocational dimensions of courses
- these challenges, and others, need tackling by those responsible for course development to improve practice in schools.

## ***Using the course specifications***

***Paul Sardar***

- ADT College have developed close links with Kingston University engineers to produce interesting, relevant and challenging design and make projects for pupils. A motorcycle racing project was described.
- Issues for national consideration include the needs to:
  - develop school/industry partnerships
  - fund schools to develop computer aided design / manufacture (CAD/CAM)
  - improve examining procedures to ensure that practical designing and making, rather than writing about these key activities, are properly rewarded in the GCSE assessment scheme.

## ***GCSE Engineering in schools: developing excellence***

***Prof. Geoffrey Harrison***

Key issues addressed included:

- What is engineering?
- What qualities does it require?
- What form should its education take?
- How are its abilities recognised and assessed?
- How and when do young people realise their own abilities for engineering?

## **Further Information**

Ofsted, Developing New Vocational Pathways: final report on the Introduction of the New GCSE, July 2004, HMI 2051, [freepublications@ofsted.gov.uk](mailto:freepublications@ofsted.gov.uk)

## **Appendix**

### ***Plenaries***

*Questions and comments after morning presentations:*

- (1) Were colleges looked at as well? *No, college courses were not inspected, but they were looked at if courses were linked between schools and colleges.*
- (2) Comment made about schools offloading difficult pupils and whether schools ensure pupils turn up ready to learn.
- (3) Did inspectors look at the work of organisations set up to promote school-industry links? *During Vocational GCSE visits little evidence was found of initiatives/organisations having an impact. This is perhaps because of the size of the sample. There is a need for a systematic approach to links between schools and a range of organisations.*

## ***Feedback from Discussion Groups (am)***

### *Accommodation*

- We need to move down modern-tech route.
- The ideal is for engineering to be part of a suite of adjacent rooms.
- There is a desire for sharing resources between schools, specialist schools and F/HE.
- Higher status needs to be given to technician support.
- We need HMI to produce good practice examples.

### *Engineering vision*

- There is tension between breadth and depth. How well does the course cover the spectrum (breadth)?
- Courses need to cater for a range of purposes – both traditional engineering jobs and other opportunities within the field.
- What type of pupil is engineering for? This needs to be clarified.
- Engineering is not for all pupils and some should be discouraged.
- There is a need to cover technician and craft skills also.
- We need to make a clear distinction between engineering and D&T.

### *Effective teaching*

An effective engineering teacher needs:

- an understanding of what engineering is; that is a broad view of the subject and an understanding of its breadth
- the ability to pull together the expertise of others
- the ability to enthuse.

### *The difference between D&T and engineering*

- Engineering has more of a focus on mathematics and science than D&T.
- Could a good D&T teacher be a good engineering teacher?
- Double award – a school's motives could relate to gaining for pupils two GCSEs rather than its ability to deliver quality teaching.

### *Other points raised:*

- Gender imbalance is a major issue.
- Work experience needs to be linked with curriculum. Business links with schools should be enhanced. It should be possible to develop 'virtual work experience'.

### **Questions and comments after Paul Sardar's presentation:**

- (1) What was the ability range on the ADT course? *Full*
- (2) How difficult was Pro-desktop for pupils? *Pupils managed to varying degrees.*
- (3) Any girls taking part? *Only one this year. Imbalance is clearly an issue, but, girls who take course out-perform boys.*
- (4) A comment was made about the male orientated nature of the college's project (motorbikes).
- (5) What is next for pupils? *Lots go on to do Engineering A Level, some go on to modern apprenticeships. Many are lost to ICT.*
- (6) Is Engineering GCSE a good introduction to Engineering A Level? *Many pupils find it difficult to come up to speed on the electronics side of the course. The approach ADT takes is to spend a year on intensive electronics.*

### **Questions and comments after Geoffrey Harrison's presentation:**

- (1) The images of students' work – there seems to be a tension between the properties of curricular and extra-curricular examples of work in terms of excitement and enthusiasm, the latter being more interesting to pupils.
- (2) Does the formal examination system allow teachers to inspire enthusiasm and excitement? Are opportunities wasted because of the demand for good results? *Response compared how judges for Young Engineers Award assess candidates. Judges ask if the specification is fully met and if the product works, whereas there is a focus on evidence in portfolios for engineering students in examinations.*
- (3) PS commented that an important part of teaching engineering is the teacher and pupil not knowing the outcome, and having to find out and get involved in the spirit of the project.
- (4) Technical drawing – why is it an enabling tool? *It is in the area of thinking skills, of visualisation. Drawing does not have to be of a high standard to be an effective instrument.*
- (5) Comment that there appears to be an irony – *CAD/CAM generated from technical drawing. 'We are too good at throwing out our practice without thinking about its value'.*
- (6) Limitations of assessment – Awarding bodies are on to this and are looking for ways forward, for example, e-assessment balanced out with traditional methods.
- (7) Need for the potential of the internet to be taken into account, for example, message boards. One delegate gave an example of using message boards and described how effective it was in stimulating interest in engineering, motivating pupils and sharing knowledge.

## ***Feedback from Discussion Groups (pm)***

### *Vocationalism*

Needs identified include:

- support for teachers (professional development and support networks)
- long-term, consistent investment
- the need to join up organisations linking schools with industry, and for this to be managed so that work matches the curriculum.

Assessment demands make it difficult for teachers to take risks but, ironically, that is what engineering is all about!

### *Accommodation*

- In some schools in the 70s and 80s, facilities were state-of-the-art compared to modern days. The current system is playing “catch up” without adequate funding.
- Mixed economy areas needed in accommodation, preferably a 3 environment room: ICT, modelling and prototyping, and a traditional making area. It should cater for mixed abilities.
- CPD needs to be linked to accommodation and resources so teachers know how to work with them.
- Higher status needs to be given to technicians.
- Is there sufficient emphasis on hi-tech elements of engineering in this GCSE course?

### *Teaching and learning*

- What are we trying to teach in engineering that is different to D&T? The strength of engineering is the taking of generic principles and their application in different contexts.
- Professional development needs to be linked to the curriculum; “quick fix” training for one day is not the answer.
- Learning is similar in both D&T and engineering with not a lot of difference between the teaching and learning of good D&T and good engineering.