



The Royal Academy
of Engineering

The Royal Academy
of Engineering
3 Carlton House Terrace
London SW1Y 5DG

Tel +44 (0) 20 7766 0600
Fax +44 (0) 20 7930 1549
www.raeng.org.uk

Direct tel +44 (0) 20 7766 0608
matthew.harrison@raeng.org.uk

Alison Wolf
Professor of Public Sector Management
King's College London
150 Stamford Street
LONDON
SE1 9NH

25 October 2010

Dear Professor Wolf

Wolf Review of 14-19 Vocational Education – Call for Evidence

The Royal Academy of Engineering is pleased to respond to your call for evidence dated 17 September 2010.

We have provided a detailed submission in Annex A which we summarise here. We believe that in order to secure the economic recovery of the UK, greater emphasis should be placed on STEM (science, technology, engineering, mathematics) subjects and disciplines in the FE & Skills sector. This includes, but is not limited to, 14-19 vocational education.

The Academy has led the FE STEM Data Project which reports soon. We are able to pinpoint the contribution that the FE & Skills sector in England makes to the provision of STEM education and skills. On the basis of that insight we conclude that:

- To progress in engineering you need mathematics so there is no 'pure' vocational route into engineering – always either an academic (or general) route or a route which offers a blend of academic and vocational qualifications. This observation generally holds true across all STEM disciplines.
- The current FE & Skills system has too great a focus on the provision of low level skills. The STEM focus in the FE & Skills system should be on the long duration, high quality, Level 3 provision required by employers and universities.
- Noting the large number of existing STEM qualifications we see a paradox: the vocational qualifications system is both restrictive (by being difficult for outsiders to navigate) and permissive (to have generated so many qualifications to date). Employers, professional bodies and universities would be better served if the system were transparent and permissive to all.
- We see little or no labour market signalling in the way individual qualifications are marketed by providers. It seems unlikely that learners could choose a qualification on the key rational indicators of quality, impact on wage return or impact on employability.

*Yours sincerely
M.F. Harrison*

Professor Matthew Harrison (Secretary)
On behalf of the Standing Committee for Education and Training



The Royal Academy of Engineering
promotes excellence in the science,
art and practice of engineering.

Registered charity number 293074

ANNEXE A

Wolf Review of 14-19 Vocational Education The Royal Academy of Engineering submission Revision 2 (22nd October 2010)

Engineering: academic and vocational

Founded in 1976, The Royal Academy of Engineering promotes the engineering and technological welfare of the country. Our fellowship - comprising the UK's most eminent engineers - provides the leadership and expertise for our activities, which focus on the relationships between engineering, technology, and the quality of life. As a national academy, we provide independent and impartial advice to Government; work to secure the next generation of engineers; and provide a voice for Britain's engineering community.

Engineering is a profession that is important to economic prosperity and to the health and well-being of society. **Our professional standards are competence based¹. Therefore we have no problem with competence based assessment for either NVQs or VRQs when this is the most appropriate form of assessment.** Our highly-valued Advanced Engineering Apprenticeships have an NVQ element which is assessed on a competence basis.

Engineering is an intellectually demanding discipline and therefore we champion rigorous assessment regimes. In our view, these may be either content based or competence based as appropriate. Again, our Advanced Engineering Apprenticeships have a Technical Certificate (such as a BTEC) which is assessed on mastery of content.

Engineering is a profession that relies on its professionals (Chartered engineers) and associate professionals (Incorporated engineers and Registered Engineering / ICT technicians) alike. Chartered Engineers generally require a Masters-level qualification accredited by a Professional Engineering Institution and Incorporated engineers generally require an accredited Bachelors-level qualification and therefore both are products of the university system. Prospective engineering undergraduates, like all prospective undergraduates, are selected on the basis of their ability. There is a generally accepted perception that high ability is signalled by high attainment in science and mathematics at both A Level and GCSE and a good grade in A Level mathematics is a pre-requisite for almost every engineering degree programme. **Students are also admitted to engineering degree programmes in many institutions on the basis of attainment in high-quality Vocationally Related Qualifications (VRQs - BTEC most commonly)** although these are commonly taken in combination with A Level mathematics.

Therefore, **the engineering profession is a considerable and important stakeholder in vocational education and in the FE & Skills system.**

Registered Technicians (EngTech and ICTTech) require a Level 3 qualification in engineering (a VRQ therefore) and demonstration of adequate competence (most commonly demonstrated by those completing an Advanced Apprenticeship through an NVQ). Technicians generally require a good GCSE in mathematics – which will be taken alongside VRQ and NVQ if not gained at school. **To progress in engineering you need mathematics so there is no 'pure' vocational route into engineering – always either an academic (or general) route or a blend of academic and vocational qualifications.**

¹ UKSPEC, Engineering Council, 2010

The Royal Academy of Engineering's involvement in the vocational education system

The Royal Academy of Engineering is well positioned to comment on the provision of STEM Vocational Education in England (including but not limited to 14-19 Vocational Education) on the basis of:

- Our leadership of the FE STEM data project.
- Our deep involvement in the development of the 14-19 Diploma in Engineering including ongoing teacher CPD and curriculum development.
- Our deep involvement in the OCR Level 3 Certificate in Mathematics for Engineering – the engineering profession's response to ensuring that the 14-19 Diploma in Engineering provides access to engineering Higher Education.
- Our leadership of the engineering strand in the LSIS 'STEM Programme' of lecturer CPD and support.
- Our deep involvement in the curriculum and workforce development of the new JCB Academy (where the 14-19 Diploma is a core offer). We are repeating this effort for the new University Technology Colleges being championed by the Baker-Dearing Trust.
- Our leadership of engineering and technology components of the DfE-BIS STEM Programme.
- Our leadership of the engineering component of the HEFCE/HEFCW HE STEM Programme.
- Our hosting of the Technician Council.

Our observations on the vocational educational system in England

Through our practical, but not un-questioning, support for vocational education and the FE & Skills sector we make the following observations on STEM vocational education based on deep interaction with schools, colleges and training providers:

- STEM is a minority in the FE & Skills system. The FE STEM Data project shows 1.19m learners taking Level 2 or 3 STEM qualifications in England with 75% of them taken in Colleges. The Association of Colleges estimate there are 3.4m learners in Colleges in England meaning that Level 2 and 3 STEM probably accounts for 26% of the learners in the English FE College system. Approximately 11% of learners in FE Colleges in England are taking Level 3 STEM qualifications. This is a small proportion, given the importance placed on Level 3 STEM qualifications by employers and Universities.
- The system is complex and easily misunderstood. At first glance, there are more than 9,000 STEM or STEM related qualifications entered on the NDAQ and LAD databases². However, the FE STEM Data Project shows that once duplicate and redundant qualifications are removed from analysis, the number drops to **2,453 different STEM and STEM related QCF qualifications that were offered by the FE & Skills sector in England in 2009/10.**

² NDAQ – National Database of – From October 25th 2010, this will be replaced by the Register of Regulated Qualifications <http://register.ofqual.gov.uk>
LAD – Learning Aim Database <http://providers.lsc.gov.uk/lad/>

- The FE & Skills system in England is configured to deliver lower level STEM qualifications. There were 2.8 million enrolments on STEM qualifications in the FE and Skills sector in England in 2009/10.

8% were at entry level,
 26% at Level 1,
 39% at Level 2,
 26% at Level 3,
 1% at Level 4+.

} **73% were at or below Level 2.**

- The system seems overly *funding-responsive*. For example, we have observed providers oscillating between BTEC Certificate or Diplomas in Engineering and the 14-19 Diploma in Engineering. When questioned they tell us that it is in direct response to funding incentives. This lack of continuity hampers employer engagement. Employers need continuity in the qualifications on offer in their locality in order to plan for future recruitment.
- Whilst there are a significant number of STEM qualifications on the QCF / LAD, there will be occasions where new qualifications are required for a specific purpose. One such occasion was the creation of the OCR Level 3 Certificate in Mathematics for Engineering. This was written and developed by the engineering profession³. We experienced great difficulties in navigating the approvals system despite the willing help of an awarding body. Therefore, we conclude that it is difficult for outsiders (employers, professional bodies, universities) to launch new vocational qualifications. Noting the number of existing qualifications **we see a paradox: the vocational qualifications system is both restrictive (by being difficult for outsiders to navigate) and permissive (to have generated so many qualifications to date)**. Employers, professional bodies and universities would be better served if the system were more transparent and permissive to all.
- The FE STEM Data Project shows that more than 80% of engineering VRQ and NVQ qualifications are awarded on 'popular' courses for which there are more than 1000 enrolments. For Level 3 BTECs for example, we find there are 63 Level 3 BTEC qualifications with engineering in the title. 75% of enrolments come from just 10 of these. At the same time, **we see little or no labour market signalling in the way individual qualifications are marketed by providers**. It seems unlikely that learners are choosing these popular qualifications on the key rational indicators of quality, impact on wage return or impact on employability. Therefore we suspect that other drivers on recruitment must be at work. Further research is required to identify and minimise these as we believe that students are better served choosing qualifications on the basis rational drivers: quality, wage return, employability.

³ <http://www.raeng.org.uk/education/diploma/maths/default.htm>

Our key questions

In assessing the current state of STEM vocational education in England we ask ourselves 4 key questions:

- **Are the volumes right?** This was, until the advent of the FE STEM Data Project, impossible to answer due to the paucity of published data from the FE & Skills sector and because the Tier 1 and Tier 2 Sector / Subject codes are unhelpful for any analysis of STEM in the sector. The FE STEM Data project defines STEM in the FE & Skills sector for the first time and tells us that **STEM enrolments in the FE & Skills sector in England dropped from 3.2m in 2008/09 to 2.8m in 2009/10**. The significance of this decline has yet to be assessed but the rapidity of the decline should be noted.
- **Are the qualifications on offer the right ones?** There are a significant number of qualifications on offer in the FE & Skills sector that are approved by the engineering profession. However, work on the 14-19 Diploma in Engineering revealed worrying gaps in the offer when it comes to Level 3 Additional and Specialist Learning. Therefore, despite the number of qualifications already available, some more targeted qualifications are still required. In addition, the current emphasis on Level 2 qualifications is a matter for concern. The standard for Registered Technicians is at Level 3.
Level 3, in our view, should be the focus for STEM in the FE & Skills sector.
- **Is the quality right?** The Engineering Council holds a list of more than 150 qualifications approved by Professional Engineering Institutions for the purposes of technician registration (EngTech and ICTTech). These are of approved quality. The 14-19 Diploma in Engineering is also widely supported by the engineering profession – as are a number of other VRQs and NVQs. But these represent a minority of the engineering and technology qualifications on offer. The quality of the others remains hard to judge against any rational indicator.
- **Is the cost right?** There is little transparency on the cost of provision for STEM vocational qualifications and therefore we find this question hard to answer. With complex funding arrangements based on age and also on level, there is little prospect for employers or individuals to understand the costs readily. However, by way of illustration:

2007 cost to the state⁴ for engineering qualifications

Level 3 VRQ - £9633
Level 2 VRQ – £3872
Level 3 NVQ - £3119
Level 2 NVQ – £3240

Exemplar 2010 fee-costs to the individual⁵ for engineering qualifications

Level 3 VRQ - £2430
Level 2 VRQ – free or up to £100
Level 3 NVQ - £1025
Level 2 NVQ - £1025

⁴ A Cost-Benefit Analysis of Apprenticeships and Other Vocational Qualifications, Steven McIntosh, Department of Economics University of Sheffield, DfES, 2007

⁵ www.s-cheshire.ac.uk

The differential in the fee-cost to the individual for Level 3 VRQs compared to Level 2 VRQs is marked and may act as a disincentive to the progression to Level 3 that we consider so important. However, we are not confident in assuming the accuracy of these cost estimates and more research is required.

In summary: because of the lack of transparency and clarity in the system, employers, professional bodies and universities cannot adequately answer the four basic questions on volume, discipline / subject coverage, quality and cost. **Therefore, we must conclude that employer and professional engagement in the vocational qualifications system is failing on the grounds that informed decisions are hampered by a lack of clarity on the facts.**

In celebration of the practical

In the Secretary of State's letter to Professor Wolf of 9 September 2010⁶, he set out his concern that in the past our education system has failed to value practical education, and that to help support our economic recovery, we need to ensure that this position does not continue.

We agree. The value the engineering profession places on a practical education for aspiring engineers and technicians is evidenced by long support for 'hands-on' activities in schools⁷ and in experience-led degree programmes⁸. However, a practical education can also be a general education, as 'practical' is a pedagogical approach and not a curriculum. We would naturally hope that all young people benefit from a practical, general education up to at least the age of 16 years, and for many up to the age of 19 or beyond.

We see 14-19 STEM vocational qualifications as entirely compatible with a preference for a practical, general education. Design & Technology, the 'practical' subject most commonly chosen by 14 year olds has only a loose connection with STEM (through resistant materials, systems and control and electronics but not through textiles, graphic products or food technology). **For learners seeking a greater hands-on component to their STEM learning, an engineering or technology VRQ taken alongside core GCSEs (Mathematics, English, Science etc.) could be an ideal combination. This is why the 14-19 Diploma in Engineering was received so well by our profession (as was the Diploma in Construction & Built Environment by the Civil Engineering component of our profession).**

The need to prioritise specific types of vocational qualification

In the Call for Evidence, Professor Wolf writes "...the review will not consider specific vocational qualifications and their content, but is instead concerned with structure and institutions."

We recommend however that the review should make distinctions between *types* of vocational qualification if not specific qualifications. Those based on National Occupational Standards (NOS) are best delivered in the workplace, preferably as part of an employer-led apprenticeship. **We believe those available for 14 year olds should not be based on NOS but should be genuinely practical and taken as part of a general education.**

⁶ <http://www.education.gov.uk/news/news/wms-wolfreview>

⁷ www.stemdirectories.org.uk

⁸ Engineering Graduates for the Future, The Royal Academy of Engineering, 2010

Comments on the overall structure of the current system

The Call for Evidence states "...Professor Wolf would be very interested in hearing what we feel to be the two or three single most important problems with current institutional, funding and accountability arrangements and why."

We comment as follows:

- The system is too 'funding responsive', too often changing the courses offered to learners in response to new funding opportunities.
- The current system has an emphasis on provision at Level 2 and below. Level 2 qualifications are known to provide little by way of wage return and do not reflect the needs of engineering industry (where technician class people with Level 3+ qualifications are predominantly sought).
- The system is too complex and opaque for outsiders to master. This is wasting opportunity for genuine engagement by employers, professional bodies and universities.

How can we improve the organisation of vocational education for 14-19 year olds?

The Call for Evidence states "Professor Wolf would also welcome views on the two or three most important changes that, in our opinion, should and could be made. This would include funding mechanisms; institutional suitability, accountability and incentives; and the role of the third sector, private training providers, employers and awarding bodies. It would also include arrangements for developing qualifications, including who bears the cost, and whether there is a need for an official quality benchmark for vocational education and awards."

The Academy's comments are as follows:

- Funding should incentivise progression beyond Level 2 in order to maximise the return to the learner and provide the skills required by engineering industry and the wider productive economy.
- The STEM focus in the FE & Skills system should be on long duration, high quality, Level 3 provision – both part time and full time.
- The post QCDA world should include much greater input from the professions. The engineering profession has already signalled its willingness to contribute to ensuring the sector meets the key requirements on volume, discipline / subject coverage, quality and cost.
- The professions should be asked to quality benchmark qualifications. Awarding bodies should be responsive to this. Quality offers should be made distinct on the QCF on the basis of the benchmarking offered by the professions.
- FE STEM data should be published annually alongside other data on the FE & Skills sector.

What is the appropriate target audience for a vocational education offer?

The Call for Evidence states “In particular from what age is it appropriate for young people to be engaging in vocational education?”

The Academy believes that up to the age of at least 16, education should be general for all. For those who want a vocational component, this should be embedded within a general *practical* education **and one that includes mathematics**. Not all schools can be expected to do this well which probably indicates the need for a high quality blended academic / vocational route for 14+ learners. The University Technical Colleges should be considered a key component of such a route. Qualifications based on National Occupational Standards should be delivered in the workplace, preferably as part of an employer-led apprenticeship.

What principles should underpin content, structure and teaching methods?

The Call for Evidence states “Specifically, how can vocational education best respond to the current and expected future labour market and how can it provide a positive incentive to participation by young people, in particular those who are at risk of disengaging from learning?”

Our comments are:

- The system is too complex and opaque for outsiders to master. This is wasting opportunity for genuine engagement by employers, professional bodies and universities.
- Labour market signals should be clearer to learners. Those qualifications with real currency amongst employers and university admissions tutors should be highlighted.
- Learners should be incentivised to undertake the study of mathematics with every STEM qualification.
- The FE & Skills Sector has a reputation for inclusiveness, offering learners ways of progressing their learning that may make up for poor attainment in earlier life. That valuable function must not be lost.

Improving progression from vocational education

The Call for Evidence asks “How can we improve progression from vocational education to positive destinations (work, Apprenticeships, FE, HE)?”

Our comments are:

- Funding should incentivise progression.
- STEM provision should focus on Level 3 where progression to both employment and further or higher education is likely.
- Better labour market signalling – let learners know which qualifications have real currency with employers.
- More transparency from Awarding Bodies. They should routinely publish results of VRQs.

The outlook for funding in the FE & Skills sector

The Comprehensive Spending Review announcement⁹ states:

“The Further Education resource budget will be reduced by 25%, or £1.1 billion, from £4.3 billion to £3.2 billion by 2014-15.

BIS will continue to support basic skills provision so that those left behind first time around can continue to gain basic numeracy and literacy skills. Adult and Community Learning will continue to be supported and the complexity and bureaucracy that hampers providers from responding to community needs will be reduced.

To ensure that businesses have the highly skilled workforce needed to drive growth the Government will boost spending on adult apprenticeships by up to £250m by 2014-15, providing up to an additional 75,000 apprenticeship places by the end of the Spending Review period.”

Although most welcome, the provision of additional 75,000 apprenticeships does not do enough to provide the variety and volume of highly skilled people needed to drive growth. For that, we assert that the following is required:

- A high proportion of the additional apprenticeships should be in STEM disciplines.
- The STEM apprenticeships should be Advanced Apprenticeships.
- Funding provision for STEM Advanced Apprenticeships should include Level 3 mathematics.

However, apprenticeships are not the sole solution to meeting the needs of employers for a skilled technician workforce. It is important to recognise that there are combinations of qualifications, taken outside apprenticeship frameworks, which provide good prospects for progression to Higher Education or to employment in Technician roles. Examples include a range of popular VRQs combined with qualifications in mathematics. The 14-19 Diploma in engineering provides a structure for such a blend of general and vocational.

⁹ www.bis.gov.uk