Skills for the Chemical Industry – Training the Teachers

About this Report

This report and the accompanying recommendations represent the outcomes of a seminar held in March 2015 that brought together more than 50 representatives from further education (FE), the chemical industry, professional bodies and other stakeholder groups to discuss the FE chemistry teaching workforce and their training needs. This work is a collaboration between the Royal Society of Chemistry, the Salters' Institute and the Gatsby Charitable Foundation.

Foreword

In June 2013, the Royal Society of Chemistry, the Salters' Institute and the Gatsby Charitable Foundation, in partnership with the Society of Chemical Industry, organised a seminar to identify key issues in the development of technical skills in chemistry in the UK[1]. One of the outcomes from the seminar was a recognition of the importance of the FE sector and in particular its capacity to meet the future education and training needs of the chemical industry.

The chemical industry has ambitious goals, and aims to increase its contribution to the UK economy by 50% – to £300bn – by 2030, becoming the country's leading manufacturing exporter. These ambitious plans will only be realised if the industry can develop a workforce of sufficient size and technical competence.

Yet UK industry continues to report difficulties in recruitment of people with the appropriate technical skills. Such skills are in high demand as the chemical industry becomes more reliant on higher-value, technically demanding jobs.

While many roles require graduate-level expertise, there is a need for highly skilled technicians[2]. FE has traditionally been an important training ground for such individuals, with a range of vocational training pathways now available.

The quality of teaching is fundamentally dependent on the quality of teachers. Yet it is unclear whether the FE teaching workforce has sufficient capacity to deliver the greater numbers of technicians that industry will require, and whether teachers have the up-to-date experience of industry that is required to prepare appropriately skilled, work-ready employees.

These were the key questions addressed at a seminar held at the Royal Society of Chemistry in March 2015, which brought together representatives from the FE and training sector, industry, professional bodies and other key stakeholder groups. The seminar heard examples of good practice from industry and the FE sector, which stimulated energetic roundtable discussions on the obstacles to the development of the FE teaching workforce as well as new opportunities to enhance interactions between industry and the FE sector.

The resulting recommendations highlight ways in which multiple communities can work together to deliver the technically skilled workforce essential to the success of the UK chemical industry.

John Holman

Sir John Holman FRSC is Emeritus Professor of Chemistry at the University of York, a member of the Council of the Royal Society of Chemistry, and Chairman of the Salters' Institute Board.

[1]Supporting Technical Skills in the Chemical Industry (Royal Society of Chemistry, 2013); available at http://www.rsc.org/images/Technician%20Seminar%20Report_tcm18-236199.pdf

[2]Technicians work throughout many of the high-growth STEM industries, are highly skilled (to around level 3 to 5), and apply their knowledge of STEM in a practical setting. Typically, technicians will be responsible for overseeing production and solving any practical problems that arise in the workplace, but many also work in research, and will often help their businesses to develop new products and processes.

Executive summary

The FE sector has a vital role to play in training and developing technicians to work in the chemical industry. With a well-documented skills gap and likely future need for additional technical staff, the need for high-quality industry-oriented education has never been greater.

Teachers are fundamental to high-quality vocational teaching and training, but there are questions about the long-term sustainability of the FE teaching workforce. Not unexpectedly, the age profile of the science, engineering and technology FE teaching workforce is skewed towards older age groups. Hence large numbers are likely to retire within the next decade, and it is not clear whether current levels of recruitment are sufficient to maintain an adequately sized workforce.

Furthermore, while many teachers do have industry experience, it was often gained several years previously and may not reflect current industrial practice. Ensuring that teachers have up-to-date experience of industry will better enable them to prepare students for the contemporary chemical industry workplace.

This points to an urgent need for all relevant groups – the FE sector, industry, professional bodies, policy-makers and other stakeholders – to work collectively to ensure that the UK has a sustainable FE workforce to provide technical education for the chemical sciences, with expertise in contemporary industrial practice and the capacity to meet industry needs.

The seminar identified a range of actions that different stakeholders need to take in order for this vision to come to fruition.

Introduction

The UK chemical industry is a national success story, contributing some £20bn to the UK's gross domestic product annually and enhancing its trade balance by £25m every day. By 2030, it aims to have established itself as the country's leading manufacturing exporter, increasing its gross value added contribution to the UK economy by 50%, from £195bn to £300bn[3].

The ambitious goals of the chemical industry are fundamentally dependent on a skilled and high-performing workforce, and hence on the continuing supply of individuals with the requisite skills and underpinning knowledge. However, skills gaps are already apparent at multiple levels, and have the potential to limit the sector's development.

Technicians make a critical contribution to the chemical industries' workforce. However, there are growing concerns about the capacity of the FE sector to deliver the required numbers of technicians to meet future demand. A seminar organised by the Royal Society of Chemistry, Gatsby Charitable Foundation and the Salters' Institute, held in March 2015 at the Royal Society of Chemistry in London, brought together more than 50 individuals from the FE sector, industry, professional bodies and other stakeholder groups to examine key issues in the FE teaching workforce, including its size and composition, and its experience of modern chemical industry practice.

[3]Chemistry Growth Strategy Group (2013). Chemistry Fuelled Growth of the UK Economy; available at http://www.cia.org.uk/Portals/0/Documents/Growth%20Strategy%20FINAL.PDF

The FE teaching workforce

It is widely recognised that the UK needs increasing numbers of technicians to support science and engineering. In part, this reflects an ageing workforce. In addition, rebalancing of the UK economy will increase the demand for highly skilled technical staff. Hence numbers need to increase for both replacement and growth.

A key question is whether the FE sector has the capacity to meet this increasing demand. A research team at the University of Leeds led by **Professor Geoff Hayward** (now at the University of Cambridge), in collaboration with York Consulting, has carried out a survey of FE colleges and teachers to build a profile of the teaching workforce in science, engineering and technology, and likely future trends[4].

Although workforce capacity and capabilities are critical questions, there is a lack of accessible and appropriately disaggregated data, at the level of individual subjects and teachers. Professor Hayward therefore sought to collect new data based on a stratified sample of 65 FE colleges and surveys of some 250 individual teachers.

In terms of gender, science teachers show a roughly 50:50 male/female split, but the technology and engineering teaching workforces show a marked skew towards males. The workforce is also skewed towards older age groups (as might be expected given that individuals typically spend time in industry before moving into teaching), and projections with reasonable assumptions suggest that, across science, engineering and IT, some 1500–2000 teachers will be leaving the workforce within a decade (around 20% of the current workforce).

Furthermore, classroom contact time is already high, at about 23–25 hours a week on average. Hence there is little spare capacity for the existing workforce to expand their teaching activities to compensate for staff retirement. Alongside this, FE institutions are experiencing worrying recruitment challenges. There are signs that the FE sector is struggling to attract appropriately qualified and experienced science, engineering and technology teachers, and as the economy continues to pick up, the sector may find it increasingly difficult to compete with industry for staff – particularly with regard to pay.

In terms of qualifications, most science teachers in FE have at least a degree-level subject qualification, and 60% hold a PGCE. Experience of industry or business is relatively common, with around 75% of teachers reporting some form of industrial/business experience relevant to their teaching. However, this was mostly gained at least five years previously, raising questions about their familiarity with current industrial practice.

Teachers across science, engineering and technology subjects recognise the importance of having up-to-date experience of industry. They expressed a strong desire for subject-specific continuing professional development (CPD) – 50% wanted industry-related/subject-specific CPD, compared with 30% expressing a desire for pedagogical CPD (9% wanted both). Through closer links with industry, teachers felt they would be better placed to enhance the work-readiness of learners.

Commending the new work, **Dr Ron Thompson** of the University of Huddersfield, which provides a substantial FE teacher education programme, reiterated the need for accurate and granular data in order to understand workforce issues. He also highlighted the relatively low capacity within the current FE workforce to increase the delivery of education and training for science technicians, and the need for CPD to be given a higher priority, particularly to enhance industry experience and subject pedagogy.

From an initial teacher education perspective, relatively few new entrants are being attracted into teaching in science, engineering and technology. Graduate incentives could be considered, but a focus solely on graduates may not be appropriate in these subject areas.

There is also clearly a need to upskill existing teaching staff, and to examine whether current CPD practices are appropriate – more than half report CPD of one day or less per year, insufficient to provide in-depth industry experience.

[4]Hayward G, Homer MS (2015). Profile Of The Science, Engineering And Technology Teaching Workforce In The College Sector In England; available at www.gatsby.org.uk/education

Developing the workforce

Roundtable discussions highlighted several ways in which the FE sector and its workforce could be developed to enhance vocational chemistry teaching. All key stakeholders – colleges, policy-makers, professional bodies and employers – can potentially make important contributions, particularly by working together towards a common vision.

Recommendations for colleges

1. **Colleges and other providers should be prepared to work together at a local or regional level to establish specialist centres in technical education for the chemical sciences.**

   It is unrealistic to expect all FE colleges to specialise in chemistry and independently develop links with industry. There are considerable challenges in developing the appropriate staffing, building and maintaining relationships with industry, and making the required investment in laboratories and equipment, particularly given that the number of students involved is relatively small.

   A more attractive and sustainable model is for colleges, providers and other bodies to cooperate at a local or regional level to achieve a sustainable critical mass at a recognised centre of excellence. It makes sense for specialist courses such as those relevant to the chemical industry to be offered at specialist sites with the capacity to develop and maintain a suitably experienced teaching workforce, up-to-date facilities, and close relationships with local industry.

   This model could also encompass networks of specialist vocational teachers, cascading knowledge through local networks. The local structures established by bodies such as the Royal Society of Chemistry could also contribute to enhanced networking, and connect FE teachers to the wider chemical science community.

   Specialist local or regional centres would also provide a stronger focus for industry, making it more obvious where companies should go to explore training opportunities for their technical staff. Larger departments would have other advantages, for example, providing greater scope to build and share expertise, and for colleagues to facilitate each other's development (as well as provide back up during absences, such as time spent on CPD).

   The potential importance of specialisation has also been stressed by the Further Education Commissioner[5].

2. **Colleges should ensure that the 'employer development officer' role is an effective conduit between industry and their chemistry teams.**

   Many colleges have established employer development officer roles or other forms of industry liaison to build relationships with local industry. Such roles have a potentially vital part to play in ensuring that courses meet local industry needs, in advising industry on the most appropriate training routes for staff and sources of funding, and in facilitating industry input into curriculum development and teaching.

   They can have most value, however, when they are embedded within specific areas of the curriculum, rather than as part of a generic employer liaison service. Although the current market size is small, it is increasing, and with greater local specialisation, colleges would be better placed to establish dedicated specialist employer development roles within chemistry teams (see case study 4). This specialist role ensures that teaching staff and the curriculum are responsive to industry needs and kept up to date.

[5]Department for Business, Innovation and Skills (2014). Further Education Commissioner Annual Report 2013/14. Available at https://www.gov.uk/government/publications/further-education-commissioner-annual-report-2013-to-2014

3. **College senior leadership teams must ensure that teaching staff routinely have opportunities to gain deep experience of the contemporary industrial workplace.**

   Industrial processes are changing rapidly, and the employer landscape is changing significantly, with dramatic growth in small and medium-sized enterprises. Although many FE teachers have experience of industry, this was often gained several years previously and may not reflect current industrial practice.

   It is essential that teaching staff are given opportunities to update their knowledge of industry, for example through industrial placements – short CPD may not be sufficient to provide the necessary depth of experience. With teachers facing heavy workloads, college senior leadership teams need to recognise the importance of 'dual professionalism', and ensure that exposure to industry becomes the norm for all teaching staff working in technical areas. This will enable teachers to use engagement with employers as a professional development opportunity, reflecting on their curriculum and pedagogy to ensure education and training provision meets the needs of industry.

   Local or regional specialisation and stronger industry engagement would also provide more opportunities for industry-linked CPD, while greater concentration of teaching staff would create more flexibility for teachers to undertake extended CPD experiences.

4. **Colleges must see themselves as offering a service to local industry, and be flexible and responsive in meeting industry needs.**

   In developing closer ties with local industry, colleges must ensure that they actively seek input from and are responsive to industry. There is a need to view industry as a 'customer', with suitable attention given to understanding its needs, liaison to ensure those needs are met, maintaining good communication and responding to feedback, and being flexible in how training is delivered.

   As part of this relationship building, opportunities may exist to generate alternative funding streams, with industry directly funding more bespoke training for employees, not necessarily linked to specific qualifications.

Recommendations for policy-makers

5. **Groups with responsibility for budgets at central and local level should work with colleges and other providers to promote the development of high-quality and sustainable specialist centres.**

   Although individual colleges should be prepared to commit to local or regional specialisation, they are likely to find it difficult to accomplish such significant shifts on their own. Other organisations, including local bodies responsible for skills capital and commissioning budgets (such as Local Enterprise Partnerships and combined authorities), can facilitate the process by championing specialisation.

6. **The vocational training landscape is complex and ever-changing: it needs to be stabilised and, ideally, simplified.**

   Qualification systems and associated funding mechanisms are not easy for industry to navigate – an issue exacerbated by the frequency at which they change. As well as imposing an additional administrative burden on industry, complex and unstable funding regimes may also discourage providers from investing in staff or facilities.

   Rationalisation and a period of stability would allow industry to gain a better understanding of qualifications and funding, and enable the FE sector and industry to work together more productively.

7. **There is an urgent need for a deeper understanding of the current and projected FE teaching workforce, to underpin strategies to develop a sustainable workforce.**

   There is a lack of high-quality data on the FE teaching workforce. Research suggests that the science, engineering and technology FE teaching workforce is, as would be expected, skewed towards older age groups. In addition, FE colleges are facing increasing difficulty in recruiting teaching staff with appropriate knowledge and industrial experience. A better understanding of the dynamics of the workforce is therefore urgently needed, in order to inform activities to cope with the imminent retirement of large numbers of staff and the likely increasing demand for skilled technicians in the chemical industries.

8. **FE teaching in specialist technical subjects such as chemistry needs to be made a more attractive career choice to those with valuable industry experience.**

   The FE sector often struggles to recruit when in competition with industry, and more needs to be done to raise the status of vocational teaching.

   Greater emphasis also needs to be given to lowering the obstacles to participation in vocational teaching by those with industrial experience, for example by building relationships between colleges and employers that allow industry employees to contribute to teaching. Incentives could also encourage late-career workers nearing retirement, or those recently retired, to apply their knowledge and skills in the sector. There is also a need for teacher training in science, engineering and technology to place more emphasis on subject-specific pedagogy.

9. **The value of non-graduate educational pathways must be communicated more widely, to teachers, students and parents.**

   Despite its critical importance to national prosperity, the vocational pathway remains the poor relation of the UK educational system. The A-level/degree pathway is widely seen as being more desirable. The FE sector has a low profile in policy discussions and its levels of funding do not match those of other educational sectors.

   The value of non-graduate educational pathways needs to be emphasised not just to young people but also to other influential groups, who may hold outdated views based on their own educational experiences – particularly parents, who have a major influence on their children's education, and managers in industry. Having typically been graduates themselves, some managers may see graduates as the solution for staffing at all levels, rather than recognising that skills can be obtained through other pathways and recruiting appropriately skilled people to particular roles.

Recommendations for industry

10. **Industry needs to commit to working constructively with the FE sector to shape training programmes, contribute to teaching and provide workplace opportunities for teachers to update their skills.**

    Industry is a beneficiary of FE-based training. While the FE sector needs to be responsive to industry needs, in return industry needs to be committed to engaging constructively with the FE sector, other companies and professional bodies, and to take the development of its technicians seriously – as many are doing (see case studies 1 and 2).

    Companies need to devote time to feeding into curriculum development and contextualisation of teaching, and provide opportunities for staff to contribute to teaching – which will also benefit their own personal development. With closer relationships and development of more bespoke training, industry could also consider increased funding of training in FE.

    Companies could also provide FE colleges with contacts best placed to identify the technical training needs of staff. Of particular importance, industry needs to offer teachers extended opportunities to update their skills, for example through placement opportunities.

Case study 1: Sellafield Ltd Technical Specialist Trainee Scheme

Donna Connor

Sellafield Ltd has worked collaboratively with its local FE training provider and university, and other employers, to develop a structured training programme for technicians.

The Sellafield nuclear reprocessing facility is a major contributor to the local economy in West Cumbria, employing some 10,000 people, most of them highly skilled. Almost a decade ago, it recognised that it had significant gaps in its workforce at technician level and that it needed to plan ahead to manage the consequences of an ageing workforce.

Sellafield Ltd has established a highly collaborative relationship with Gen2, a local training organisation established by five partner companies that specialises in nuclear and engineering technologies, and the University of Cumbria to develop an industry-oriented training programme of up to five years, enabling companies to 'grow their own graduates'. The emphasis has been on flexible, modular courses with a strong focus on contextualised learning to ensure relevance to the workplace. Graduates can specialise in a range of areas, depending on their likely industrial role. This approach has enabled other local employers to utilise the scheme and develop additional modules that meet their needs.

The initiative has encouraged local providers to work together, and the partnership approach has extended to professional bodies that have accredited courses and thereby provided important quality assurance.

Staff at Sellafield have also been mobilised to contribute to teaching programmes. Although they do not receive formal training, staff have opportunities to observe other teachers in action and receive support in development of materials from both the company and experienced providers. In general, staff have been positive about participating, and see it as contributing to their own personal development.

Building on this experience, Sellafield is also pioneering degree-level apprenticeships. There is strong demand for such qualifications, which have a heavy emphasis on workplace learning. Individuals undertaking them appear to be progressing well in companies, having become familiarised with the workplace from an early age.

Given its size, Sellafield can have significant influence by providing a critical mass of learners. Nevertheless, smaller companies could achieve a similar impact by partnering or working together at a local level.

Case study 2: Altus Science Ltd Technician training at SMEs

Andy Stag

A small company, Altus Science Ltd has worked closely with a local FE college to develop a bespoke training schedule for two technicians.

Small and medium-sized enterprises rarely have the resources or capacity to commit to developing training programmes. But by working closely with local FE colleges, workplace-oriented technical training can be developed even for small numbers of staff.

Altus was set up in 2012 and spent its first year establishing a platform for rapid future growth. Part of this foundation was to develop a clear vision of the technical roles it would need, including individual job specifications. Its aim was to develop people from within, using apprenticeships. It liaised with Cogent, the expert skills body for science-based industries, to identify possible local FE college partners offering level 4 higher apprenticeships, eventually choosing to work with Wirral Metropolitan College. It then worked with Wirral on the specific modules to include in a training programme.

While the company originally planned to recruit one technician, it eventually selected two very able candidates. However, despite careful planning, the students' initial experience was not positive. The College reacted promptly to the feedback, and made changes to address the students' and company's concerns. After six months, the company is pleased with the students' progress.

The success of the partnership has been based on extensive dialogue between all parties. As well as initial discussions between the company and the college, the company has weekly meetings with the students and three-monthly sessions with the college. Indeed, the onus is on all three groups to make training a success – employers must take training seriously and invest their time, despite many competing pressures, colleges must be willing to listen and respond to employers, and students must think about how they apply their learning in the workplace.

Altus has benefited from funding for the fees of the students from the Royal Society of Chemistry's Higher Apprenticeship grant. This grant is one of the benefits offered by the Royal Society of Chemistry's dedicated service for micro, small and medium-sized companies, EnterprisePlus.

Case study 3: Newcastle College Building employer links

Julie Hizzett

Newcastle College is aiming to build its relationships with local employers, to ensure its provision meets their needs and that teachers have up-to-date experience of industry.

Newcastle College offers a wide range of courses, from provision for 14–16-years-olds to degree-level courses. It has a strong focus on part-time provision for day-release students, often maintaining a relationship with students (and hence employers) for several years. The College can thus see how its work is contributing to the rapid rise of students through companies.

The College is committed to gaining input from industry in the design of its courses. Flexibility of courses is crucial. Level 3 courses, for example, include a foundation year followed by a second in which students (with input from their employers) can select from 20 modules. It also runs a BSc in laboratory management providing practical guidance on how to run a laboratory, encompassing 'soft' as well as technical skills.

The extensive links with industry enable students to experience a wide range of industrial settings, sometimes on a scale they will not have previously encountered. Full-time students can also take advantage of these visits. Company employees act as guest lecturers, providing first-hand experience of the application of technical skills.

A further benefit is that staff are able to undertake placements of up to two weeks in industry out of term time, to update their skills and to experience new areas of work. The College hopes to expand the range of such opportunities available to staff.

The College is keen to engage with more employers. One significant issue is identifying the most suitable liaison person in a company – HR staff or people responsible for training may not be aware of the detailed technical skills required by staff in scientific technician roles.

Case study 4: Wirral Metropolitan College Specialising in chemistry

Heather Aspinwall

Situated in an industrial heartland, Wirral Metropolitan College has developed particular strengths in chemistry, through close liaison with small and large companies based locally.

Wirral Metropolitan College sits in an area with a strong manufacturing heritage. During the past 60 years it has developed an ongoing relationship with local companies, and has a strong focus on meeting the training needs of employers, particularly those in the chemical industry.

Of particular importance are dedicated employer development officers responsible for employer liaison. Such staff are the first point of call for industry, and aim to deliver a fast, flexible and responsive service. Importantly, they are associated with specific areas of the curriculum, so specialists can work jointly with employers in areas such as curriculum development.

Wirral has a sizeable chemistry team, including five chemists and two chemical engineers. Four staff are educated to PhD level and all have experience of R&D or industry. It has four technicians, a mix of highly experienced staff and upcoming staff who have recently completed apprenticeships. It has also invested heavily in its laboratory facilities.

It aims to ensure that students can progress, for example from apprenticeships to higher-level apprenticeships or from higher-level apprenticeships to degrees. It also aims to be responsive to employer needs and flexible, offering multiple modules, delivering on employer sites, and offering alternative start dates outside standard term times, and responding to a growing industry interest in traineeships. As well as industry, it seeks to build relationships with other important stakeholders such as professional bodies.

Among the challenges it faces are difficulties in maintaining staffing, the ongoing need for investment in labs, a lack of awareness among some employers about technician-level skills, and the complex and rapidly changing funding environment.

List of participants

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Royal Society of Chemistry

The Royal Society of Chemistry is the world's leading chemistry community, advancing excellence in the chemical sciences. With over 53,000 members and a knowledge business that spans the globe, we are the UK's professional body for chemical scientists; a not-for-profit organisation with 170 years of history and an international vision of the future. We promote, support and celebrate chemistry. We work to shape the future of the chemical sciences – for the benefit of science and humanity.

Salters' Institute

The Salters' Institute, founded in 1918, is the flagship charity of the Salters' Company, ranked 9th in order of the Twelve Great City of London Livery Companies. The Institute aims to promote the appreciation of chemistry and related sciences amongst the young, and to encourage careers in the teaching of chemistry and in the UK chemical and allied industries. The Institute's three core activities are: Salters' Chemistry Camps, Salters' Festivals of Chemistry and Curriculum Development.

Gatsby Charitable Foundation

Gatsby is a foundation set up by David Sainsbury to realise his charitable objectives. Gatsby works in areas that David Sainsbury and the Trustees are particularly passionate about and where they believe charitable funding can make a real difference. Gatsby is active in six tightly focused areas:

- Plant science research.
- Neuroscience research.
- Science and engineering education.
- Economic development in Africa.
- Public policy and research advice.
- The Arts.

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