

Royal Society of Chemistry (RSC) response to the National Assembly for Wales, Enterprise and Learning Committee consultation on STEM skills in Wales

The Royal Society of Chemistry (RSC) welcomes the opportunity to respond to the consultation on STEM Skills in Wales, coordinated by the National Assembly of Wales Enterprise and Learning Committee. The core sciences, in particular the chemical sciences, have much value to add in contributing towards Wales' STEM skills needs.

The RSC is the UK Professional Body for chemical scientists and an international Learned Society for advancing the chemical sciences. Supported by a network of over 46,000 members worldwide and an internationally acclaimed publishing business, our activities span education and training, conferences and science policy, and the promotion of the chemical sciences to the public.

This document represents the views of the RSC. The RSC's Royal Charter obliges it to serve the public interest by acting in an independent advisory capacity, and we are happy for this submission to be put into the public domain.

The RSC is encouraged by the recently announced 'STEM Cymru' initiative and hopes the Welsh Assembly Government will consider the points raised in this document as this programme develops.

Key Issues

- A relevant and engaging curriculum for STEM subjects is vital in encouraging students to progress to further study in STEM subjects.
- STEM subjects should be taught in schools and colleges by subject specialists who have access to appropriate subject specific and ICT training throughout their careers.
- In order to ensure that STEM training meets the needs of society and the work place, employers need to be involved in shaping the strategy and content of training to ensure that the relevant knowledge and skills are provided.
- The Welsh labour market needs to engage more effectively with STEM skill providers and the Welsh Assembly Government to determine the relevant skills required in the workplace.

The adequacy of provision of STEM skills through schools, FE colleges, higher education and work-based learning.

The RSC agree that greater support for Science, Technology, Engineering and Maths (STEM) education in Welsh schools and universities must be provided to generate a steady supply of talented, highly-skilled individuals who will become the next generation of scientists and engineers and members of a wider, scientifically literate workforce.

The school curriculum is often dictated by examination content, fails to challenge brighter pupils, and also lacks adequate practical and mathematical skills. The investigative approach to practical work often inhibits acquisition of basic and in depth STEM skills. It is perceived that there is a lack of 'depth' in the current chemistry curriculum and as such the curriculum must be enhanced with interesting, relevant content, giving all pupils a thorough grounding in scientific principles.

An overhaul of the Welsh education system is required to strengthen the quality of science education in Welsh schools. Fostering a passion for STEM during these earlier stages will encourage more young people to pursue specialised higher training that will ultimately lead to better career prospects. The curriculum needs to challenge and inspire pupils, and should not be dictated by examination content and teaching. Employers, educators and professional bodies must work together to promote STEM subjects to young people as a pathway into STEM related careers.

In addition, new technologies need to be fully embraced. Many teachers are unskilled in the development and use of ICT for themselves and more importantly, for their students to use at home.

Supporting STEM in Universities

STEM in Welsh universities must be fully supported with a sustainable, long-term system of funding.

Chemistry has virtually disappeared from higher education institutions in Wales except in the Cardiff area and in Bangor. Since chemistry is responsible for over 20% of the UK GDP, Wales may be missing economic opportunities that are available to the rest of the UK. Furthermore, the lack of provision at HE level will have a knock-on effect for availability of specialist chemistry school teachers.

To this end, we must ensure that research and education for, laboratory based subjects like chemistry and physics, which are expensive to teach, are fully funded and supported. Current funding arrangements do not adequately cover the costs of teaching and research in Welsh universities. A sustainable and long-term system of funding for science is therefore required.

The additional funding to support and promote STEM skills and whether the current supply of STEM skills is meeting the needs of the Welsh labour market, including international comparison with selected relevant countries and regions.

A sound investment in STEM skills would provide returns for generations to come, forming a vital part of the skills pipeline that will fuel the Welsh industries of the future.

In Wales the provision for training through the General Teaching Council for Wales (GTCW) has been withdrawn. A new mechanism for developing training needs to be introduced, possibly via the 'web'; although this is not as effective as face to face interactions. A considerable number of teachers report that they would like to further develop their skills, but are too hard pressed for time to find the opportunity to improve.

In the current economic climate, it is increasingly important to develop transferable STEM skills within the Welsh workforce. Workers with high-level STEM skills are well placed to translate these skills into other sectors. Chemical scientists are renowned for their ability to transfer their skills set to other, often, unrelated careers.¹ The transferable value of STEM skills should be further communicated to the Welsh labour market.

Specific ways in which postgraduate STEM provision can flexibly meet the needs of the Welsh labour market include:

- Tailored Masters courses
- Focusing PhD programmes on high quality research that will enhance the Welsh science base and new sectors as they develop.
- contribution of business to developing a flexible and adaptive system of postgraduate education to ensure the needs of the labour market are met.

As new, specific skills needs emerge in the Welsh labour market, modules relating to these skills should be developed and incorporated into existing courses. Care must be taken to ensure that the resulting qualifications meet the standards required by the professional bodies and national guidelines.

The supply of educational professionals able to teach STEM subjects and the impact of Initial Teacher Training Grants and the Graduate Teacher Programme on recruiting STEM teachers and education professionals.

There is a concern that not enough science specialists are being recruited to teach specific STEM subjects. Many who teach chemistry are not graduate chemists, resulting in inadequate subject knowledge. Recruiting the correct proportion of STEM subject graduates

¹ http://www.prospects.ac.uk/what_do_graduates_do_chemistry.htm

must be addressed. For example, there is an excess of teachers that are qualified in biology but not in physics and chemistry. A recent Government report showed that only 25% of science teachers have a specialism in chemistry,² and 19% have a specialism in physics. Pupils who are not challenged are not engaged, and teachers who do not have a deep knowledge of their subject will struggle to inspire their pupils.

The effectiveness of education and business links between education institutions and STEM employers.

Industry needs to engage more effectively with HE providers to determine and help develop the skills that the Welsh labour market requires. Similarly, universities need to communicate expected skills for A-level students and A-level courses for GCSE students to ensure the STEM skills pipeline is seamless. The RSC is already working with Pfizer on a new initiative, Discover Chemistry, which will centre on the skills needed from graduates to ensure the chemical industry continues to thrive in the UK.³ These core skills will be fundamental to emerging STEM related sectors in the UK. Similar principals could be applied to sectors of specific importance to the Welsh economy.

In addition, we must ensure that regional science parks are supporting innovation and fostering local industry/academic partnerships to maintain demand for high level STEM skills. These partnerships may be partly funded by business with additional funding from the Welsh Assembly Government to support small & medium enterprises (SMEs).

The publishing of salary data may be effective in attracting young people to these career paths. Science centres will have a large role to play, by enabling families and schools to experience large demonstrations of new technologies that would be impossible in the classroom. School careers advisers need to be appropriately trained to enable them to champion the STEM subjects. High quality careers advice should be available to all young people, regardless of their socioeconomic background. Apprenticeships will form an important part of the STEM skills pipeline, however the provision of high-level STEM skills should remain the top priority.

Links between education and businesses could be improved by:

- Establishing higher level partnerships, such as industrial placements for research students,
- Establishing partnerships with businesses – state-maintained and independently run schools with outside sponsorship.
- Developing industry-led Business Technology Centres (BTCs) and Doctoral Training Centres (DTCs), specifically tailored for Welsh industries to increase industry buy-in and investment.

The implementation and impact of strategic policies and government initiatives to foster STEM skills including the role of the Chief Scientific Advisor, the National Science Academy and the Welsh Government's 'Skills that Work for Wales' and 'For our Future' (higher education) strategies and 'A Science Policy for Wales' document.

The values and aspirations of the 2006 'A Science Policy for Wales' document are generally sound. There is however a feeling that the focus of this scientific 'push' has been directed too heavily towards the higher education community without proper engagement of the commercial sector. Such engagement will be required to create *demand* for STEM skills in the Welsh labour market. There is also a feeling that policies have changed too quickly, so that they do not have time to bring about the intended benefits. An example would be the recent scrapping of the Single Investment Fund.

Greater interaction and networking between the Welsh commercial sector and academia needs to be encouraged. This involves greater commitment from commercial partners to both

² Mathematics and Science in Secondary Schools. The Deployment of Teachers and Support Staff to Deliver the Curriculum, DFES, 2006

³ <http://www.rsc.org/Education/DiscoverChemistry/>

fund and engage in this process. Developing a more supportive environment for the commercial technology sector may need to take place in the first instance if commercial-academic collaboration initiatives are to be successful. Revised policies to increase the provision of commercial facilities are needed. Appropriate measures should be incorporated to avoid high financial premiums and unhelpful terms of occupation that may make such facilities unattractive or unfeasible for start-up companies and SMEs.

A targeted and more focused plan, that better understands and incorporates the needs of Welsh industry and business, is required. Such a strategy could avoid the requirement of large public sector capital investment projects by fostering greater commercial buy-in and learning from the experiences of existing companies. The losses incurred by the Technium projects suggest that a big building plan may not be the best solution to develop strength in the Welsh science base. There is a feeling that these projects ultimately did not develop into the desired technology incubators that were intended.