

Enterprise and Learning Committee

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Inquiry into the STEM Agenda

Engineering Education Scheme Wales (EESW)

The Background

The Welsh Assembly Government has recognised the need for increased numbers of students taking Science Technology Engineering and Maths (STEM) subjects. In its Skills That Work for Wales- A Skills and Employment Strategy and Action, it noted that Wales has made excellent progress on jobs and skills over recent years, but the rest of the world is not standing still.

The Leitch Review advised that the UK must urgently raise achievements to keep up with the world's leading countries. Skills at all levels are becoming increasingly important for the success of individuals, businesses, and communities. A highly-skilled workforce is essential for an innovative knowledge economy.

The CBI, in its Ready to grow: Business Priorities for Education and skills survey published in May 2010, said that "Employers are looking for young people with strong employability skills, including the ability to solve problems, work in teams, and manage their time effectively. But more needs to be done to address the weaknesses in the soft skills of school/college leavers and graduates".

The Royal Academy of Engineering in its briefing paper- Engineering the future - a Vision for the Future of UK Engineering, published this year, states that engineering and technology skills are of immense value for a variety of reasons: they are a core component in establishing an international comparative advantage in a range of sectors. Engineering at all levels is underpinned by the STEM learned at school. While there have been significant increases in the number of people studying mathematics after the age of 16, advances in the number of people studying science, design and technology and engineering have only been modest. There must be more focus on STEM in schools and colleges and young people must be taught STEM subjects by STEM specialists in order that they can attain and progress with these important subjects.

As director of the Engineering Education Scheme in Wales (EESW) I manage a scheme that has been operating successfully in since 1989 and has provided a substantial and sustained contribution to the STEM

agenda in Wales by enhancing sixth form students' academic and personal development. Approximately 450 students per annum register with the scheme. Project activities involve each student in upwards of 120 hours of contact time with induction days, visits to companies, university workshops, presentation events, plus considerable time researching, designing, planning, producing prototype solutions and preparing a report and presentation. This substantial interaction has been a significant influence on young people over the years helping them confirm choices to pursue careers in STEM related areas.

Following the amalgamation of the Technology Alliance Wales (TAW) and EESW, the range of activities has broadened to encompass pupils from the primary sector up to sixth form and college levels. EESW has been successful in gaining European Union funding to enhance its activities with the secondary sector in Convergence areas in Wales. Activities now include the F1 Challenge, Primary Engineering, Girls' into Engineering, support for the Colegau Cymru Engineering week and Headstart. All of these provide pupils with exciting and motivating contexts to develop their interest and improve standards in STEM subjects. Together, they provide an array of opportunities for young people to develop essential and key skills through practical experiences and to have their progress recognised through various forms of accreditation. The funding also allows for an expansion to implement new strategies to encourage the uptake of STEM related learning and to encourage more girls into engineering.

The need to find different and innovative ways to engage pupils with STEM subjects is important and EESW offers a range of activities to facilitate this. Our philosophy is based on the enhancement and application of mathematical and scientific skills through technological and engineering activities. In this way pupils develop STEM skills in an integrated way. The activities also encourage wider learning and the application and development of key and employability skills such as team work, problem solving and time management.

It is vital to our economy and to the country's prosperity that we maintain and develop interest in STEM subjects. We need the right people with the right skills to build a strong manufacturing and research base and to this end we need to ensure a good supply of scientists, engineers, technologists and mathematicians. There are many initiatives taking place in Wales in the name of STEM. However, they lack coordination and validation and are not, in total, either efficient or effective and do not give a complete coverage of all schools. We need, therefore, to rationalise these and build on the best

ones. By doing so, we believe we can achieve a much better result for the same amount of money.

At school level there is an emphasis on the Science and Maths components of STEM but Technology and Engineering are generally treated as less important. National curriculum Design and Technology has an over emphasis on 'soft' technologies such as textiles, cooking, graphics and product design. The 'harder' technologies, more closely related to engineering such as electronics and computer control, are marginalised in most schools. These are important disciplines for the future skills agenda and should get a higher profile in education from KS2 through to the sixth form. For example, recent conversations with higher education and electronics companies indicate that pupils who have an 'A' level in electronics are at an advantage for HE courses and employment.

There is also a problem with the lack of specialist teachers for STEM subjects. All of the disciplines with the STEM family are short of appropriately qualified teachers in the majority of school. The number of teachers registered with GTCW in their 2010 Annual Statistics Digest for Engineering (8) and electronics (24) is very low and should be a cause for concern. It would contribute significantly to raising standards and interest in STEM subject if engineers were encouraged into teaching. These professional have good mathematical and scientific understanding and, importantly, experience of using these disciplines in practical situations. One of the failings of maths and science teaching is often the inability to contextualise the subject content being taught. This is why EESW provides a range of activities which, in addition to being motivating and exciting, allow pupils to see the application of STEM skills. This contextualised learning has proved to be very successful with a range of abilities and ages from primary up to the sixth form.

The recent appointment of the Chief Scientific Adviser and the establishment of the Science Academy have done little to help redress the balance within the STEM family and the apparent adoption of engineering, as a junior partner, by science does not give engineering and manufacturing the status it deserves or needs to contribute to the stability and growth of Welsh economy.

Summary / Recommendations

The outcomes from the review might cover the following:

- An investigation of current and future demand for STEM skills through an employer audit into their current and future requirements at a generic and specific level. This would focus on

the volume demand of employers such as the utilities, engineering plants and manufacturers. The study would also look at the future potential for graduate employment vs apprentices. There are mixed messages about the situation with the uptake of STEM subjects and part of the review should set up an investigation to discover the true facts

- An Investigation into the current supply of STEM skills by analysing the numbers choosing STEM subjects in post-16 education and in higher education.
- The number of HE and FE graduates who stay in Wales.
- Establishing a quality audit for STEM teaching in schools, FEIs and HEIs, which could include teachers trained in the relevant subjects, number of schools offering which subjects, employer engagement in curriculum development, number of teacher/lecturers with some work experience in their fields of expertise?
- Finding out how best to support STEM through schools, post-16 education and universities. What is out there? What works best?
- Streamlining the current numerous STEM initiatives and implement them more effectively in schools and colleges.
- Improving the number and quality of STEM teachers and lecturers who can bring relevance to the curriculum.
- Commissioning publications to advise schools on the ways in which science and maths can be developed through application in technology and engineering activities.
- Exploring ways of raising the profile of engineering and electronics in school curricula.
- Exploring the possibility of one high level STEM Strategy Group that will join up STEM across all phases of education and make recommendations to Ministers about national STEM priorities. This group should be employer led.
- Identifying organisations and activities that will best capture the imagination of people to become the scientists, technologists, engineers and mathematicians of the future, and help them reach their full potential.

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