

## **Written Response to the Enterprise and Business Committee's Report on Science, Technology, Engineering and Maths (STEM) Skills by the Minister for Education and Skills**

**November 2014**

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I would like to set out my response to the recommendations of the Enterprise and Business Committee's Report on Science, Technology, Engineering and Mathematics (STEM) skills.

I welcome the Committee's consideration of the STEM agenda. A good knowledge of STEM subjects is really important for a well-rounded education. We need to inspire young people to take an interest in STEM subjects and raise their awareness of the future career opportunities that an aptitude in these subjects can open up.

I have noted the recommendations of the Committee's report. Although some of the recommendations are accepted in principle, as they require some further consideration, overall these recommendations are consistent with our current policy direction. I would like to emphasise that our strategic vision, underpinned by the *Science for Wales* document, is supporting an increasing focus on promoting and developing the study of STEM subjects.

To help in carrying forward our work, I have agreed new funding of £600,000 per annum over the next two years to support the teaching and learning of science in schools. This includes teacher development and the production of learning materials designed to improve science literacy skills and overall knowledge. From September, we are also now supporting a science advisory function based within [the four education consortia](#), with a specific secondary school focus.

We provide grant funding to Techniquest and Techniquest Glyndŵr to support education programmes aimed at enhancing the provision of science and mathematics in both primary and secondary schools. From April, I have asked that

Technique places a key strategic priority in its delivery of enrichment activity on engaging and enthusing larger numbers of girls to study science subjects. From September, this work includes a pilot project with the Institute of Physics (IoP), delivering outreach activity to learners in a number of Schools Challenge Cymru schools, and others. There is also mentoring support for non-specialist secondary physics teachers, modelled on that provided through the IoP's successful Stimulating Physics Network programme. I look forward to sight of initial analysis of how that pilot is impacting on the teaching and learning of physics in the two pilot clusters, in the coming months.

This is also an important element within our new *Focus on Science* campaign, which I launched on 24 October. The campaign reinforces the message of the importance of science study and links directly with our new *Qualified for Life* plan. Over the year ahead, *Focus on Science* will support primary and secondary schools, pupils and parents, providing more bilingual resources and promoting awareness of and interest in science through competitions, awards and events.

The importance that we are placing on the study of science subjects is also clearly demonstrated in the recent agreement to include science qualifications within the select group of qualifications that count towards school performance measures at Key Stage 4. From 2017, in addition to the two new mathematics GCSEs, a learner's best two science qualifications will contribute towards the new capped points score. And from 2018, this will be a learner's best two science GCSEs, following introduction of new science GCSEs for first teaching from September 2016.

In terms of the mathematics agenda, the Further Mathematics Support Programme (FMSP), benefiting from our funding support, is widening access to Further Mathematics at GCE AS/A2 Levels. A recent evaluation of the programme has provided a very positive assessment of the impact of this provision. I will be bringing forward arrangements shortly to consider what lessons we can learn from approaches such as the FMSP, with a view to further positive impact on attainment in mathematics more widely.

In broader terms, the ongoing work on Professor Graham Donaldson's review of the curriculum, due to report at the turn of the year, will, I anticipate also result in positive changes to support the teaching and learning of STEM subjects.

Wales needs a strong base of people with good STEM knowledge, skills and qualifications to support economic development and future prosperity. I am confident that, through the wide range of activities the Welsh Government is supporting on the STEM agenda, we are heading in the right direction in developing the STEM skills of our young people, increasing the numbers studying STEM subjects, and building our pool of talent.

I set out below my response to the Report's individual recommendations.

The Committee recommends that:

1. Under the guidance of the Chief Scientific Adviser for Wales, continue to develop a coherent plan for the promotion, monitoring and evaluation of STEM enrichment projects undertaken through the National Science Academy hubs, and involve both the Department for Education and the Department for Economy, Science and Transport in that process.

**Response: Accept**

This work is already in progress, as the Committee's recommendation acknowledges. The Chief Scientific Adviser for Wales is currently reviewing the operation of the National Science Academy (NSA) in conjunction with my officials in the Department for Education and Skills (DfES) and her own support staff in the Department for the Economy, Science and Transport (EST).

**Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

2. Prioritise its investment in early interventions that can enthuse children in STEM and inspire them throughout their entire education, but ensure those interventions are long-term and pan-Wales.

## **Response: Accept in principle**

The independent review of the National Curriculum and assessment in Wales, being led by Professor Graham Donaldson and due to report in early 2015, is considering the picture in terms of the format and structure for the teaching of science subjects within the curriculum.

The Welsh Government wishes to see STEM engagement activities being made available from the early years as part of the range of provision. Indeed, we have recently funded a Stemnet pilot study focusing on primary school children and their teachers. The importance of capturing children's attention early is recognised; but Welsh Government support for STEM enrichment needs to take into account the wider STEM opportunities available to schools at each key stage of learning. At Key Stage 4, we are introducing new mathematics GCSEs from September 2015, and will be revising the science suite of GCSEs for first teaching from 2016. In post-16 learning, revised science A levels will be implemented from September 2015 and we currently plan revised A levels in mathematics from 2016. Ensuring that these qualifications are relevant and engaging is an important part of our revisions.

We are also making changes to school performance measures that will encourage take-up of science and mathematics GCSEs. To maximise impact, it remains essential that resources are directed with care. The balance of funding across key stages is a consideration being taken forward within the review of the NSA which is currently in progress.

## **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

3. Respond swiftly to the ICT review report's recommendation to change computing in the curriculum so that Wales can produce the technologists needed by the computing industry in the future.

## **Response: Accept**

The independent review of the National Curriculum and assessment in Wales is considering closely the ICT Task and Finish Group's recommendations, and will be reporting at the turn of the year. I have recently published a working copy of the principles for curriculum design that are being developed by the review to both evaluate current practice and guide proposals for the future.

Additionally, I have authorised the creation of a three-year professional development programme for practitioners to improve computing, ICT and digital literacy skills in schools. The funding will be provided to local authorities over the period December 2013 to March 2016, to support the effective use of Hwb+ to meet key education objectives. Funding is also being provided to Technocamps during

September 2014 to March 2016 to provide programming skills workshops for pupils and teachers in secondary schools.

### **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

4. Encourage schools to play a more active role in replacing the services previously carried out by Careers Wales, and support them in liaising with employers and organising relevant, timely and meaningful STEM placements for young people.

### **Response: Accept**

Careers Wales continues to play an active and essential role in the delivery of impartial careers information and guidance; and continues to support schools through that work.

Estyn's thematic inspection of Careers and the World of Work (Informed Decisions – October 2012) highlighted areas where schools in Wales need to develop further the provision of careers information, particularly in respect of their delivery of the Careers and the World of Work framework. Specifically, Estyn identified that "the recent reductions in services from Careers Wales have put a strain on the capacity of schools to deliver Careers and the World of Work".

We are committed to strengthening school-employer engagement, and *Qualified for Life*, our education improvement plan (September 2014), highlights that we will direct Careers Wales to support the development of stronger and more sustainable partnerships between schools, colleges and employers. Careers Wales will continue to support school / employer engagement with a brokerage function and specific programmes, such as preparatory training for industry representatives and guidance for schools.

We will also initiate an 'Enhanced Employer Engagement' project to strengthen employer engagement in schools and help build capacity of schools to deliver Careers and the World of Work more effectively.

### **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

5. Ensure that the revised Welsh Baccalaureate leads to the development of higher-level STEM work experiences similar to the approach taken to providing higher and lower-level apprenticeships.

**Response: Accept in principle**

The revised Welsh Baccalaureate is designed to have a renewed focus on the development of the skills that all learners need for their future, either in employment or in further learning. For that reason, the only specific qualifications that are required as part of the revised Welsh Baccalaureate are the new GCSEs in Mathematics – Numeracy and English or Welsh Language, which emphasise numeracy and literacy skills.

However, while there is no specific requirement on schools to include science and technology activity as part of their delivery of the new Welsh Baccalaureate, the framework provides real opportunities to highlight the value of STEM through the challenges which form the assessment of the skills. There are also opportunities for schools to engage with employers and other external bodies both in developing skills and in delivering the challenges, and I expect the associated guidance to schools to highlight such opportunities.

**Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

6. Target interventions from year 7 onwards, so that students receive accurate and impartial careers advice before they have to make crucial subject choices, and ensure that advice is provided in person as well as online through a significantly improved Careers Wales website.

**Response: Accept in principle**

Both Careers Wales and schools should ensure that appropriate information and guidance is available to learners when they are undertaking key decisions on their study options.

The annual remit for Careers Wales includes an ongoing requirement for the organisation to deliver a service to young people that focuses more intensive support upon prioritised client groups. Depending on circumstance and need, a young person may receive a one-to-one careers guidance interview; a group session with other young people with similar interests or needs; access to awareness-raising sessions; or support in accessing the website. Careers events, such as the recent Skills Cymru events in North and South Wales, are also supported. Where young people face particular challenges, they may be case-loaded by a Careers Adviser to improve the continuity of personal support.

The careerswales.com website contains many resources to help young people make decisions on study options, including specific information on STEM opportunities. Alongside face-to-face interactions, young people also have access to a phone service and web-chat services which can support access to the site and provide wider support.

The Careers Wales website receives 1.9 million visits per year and is presently used to support and provide a wide range of services. These include:

- Careers Information (factsheets, e-clips, case studies, etc)
- Career Management Tools (e.g. CV builders, quizzes, etc)
- Option selection for 14 year olds
- Access to Courses in Wales database
- Jobs Growth Wales application
- Apprenticeship Matching Service
- Common Area Prospectus (pilot areas only)
- National Work Experience Database
- Labour Market Information tools
- Job vacancy services for 16-17 year olds

Improvements to the careerswales.com website are in progress, and are part of a programme of review and updating of both the information content and technical framework of the website.

Careers Wales is also working to improve the accessibility of labour market information – particularly for younger users. In December 2014, there will be updates to the website resulting in labour market intelligence being presented in a more accessible, visual and user-friendly manner. This will enable users of the website who are researching career options to quickly gain a visual snap shot of the key information and characteristics of a potential career. Information including average wages, hours, type of work, level of qualifications needed, and level of demand in Wales will be presented in a simplified ‘icon’ based format.

Careers Wales is currently developing an online Common Application Process to work alongside the existing Local Area Prospectus in support of the Youth Guarantee at age 16. This is one of the key commitments of the Youth Engagement and Progression Framework.

From September 2014, schools and colleges are able to update their courses in the online prospectus for the 2015-16 curriculum offer. The objective is for Careers Wales to “go live” with the application process across Wales in September 2015 for school and college courses.

### **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

7. Target Continuous Professional Development (CPD) based on accurate and up-to-date data on where it is most needed, and in particular, support and monitor Estyn's 2013 recommendations that primary schools should provide more training for teachers with weak science subject knowledge.

**Response: Accept**

*Qualified for Life* includes, as its first strategic objective, 'An excellent professional workforce with strong pedagogy based on an understanding of what works'. The Professional Learning Model which I announced in June set a strategic vision for the development of professional learning to support this objective. The Professional Learning Model is designed to raise the professionalism of all practitioners; to improve the quality of professional practice; and to build the capacity of the whole education workforce. It is based on the following key characteristics that have the greatest impact on improving classroom practice:

- Effective use of data and research evidence
- Reflective practice
- Coaching and mentoring
- Collaborative learning

Effective, career-long professional learning forms an integral part of school improvement. This is centred on an annual school-based cycle of self-evaluation and planning for improvement. Regulations came into force on 27 October that require all schools to have in place a rolling three-year School Development Plan (SDP) that sets out their priorities and targets and shows how resources will be allocated. This will include setting out how the school intends to develop its staff. The National Model of Regional Working sets out the role of regional consortia, through the deployment of Challenge Advisers, in supporting schools in this process.

In practice, this means that practitioners' professional learning needs will be identified at school level and it is also where the nature of professional learning activities will be identified that best address needs. In carrying out their self-evaluation, schools should consider how well placed they are to deliver the curriculum and meet the needs of their learners, including STEM subjects. Action to address areas of development, including any necessary improvement of teaching skills, should be set out in the SDP with the actions that will be taken.

This ensures that professional learning takes account of actual need and avoids a 'one size fits all' approach to professional learning. Where self-evaluation and planning is robust, schools will, for example, identify where they fall within the scope of Estyn's findings on STEM teaching skills and take the necessary action to improve practice.

The effectiveness of schools' improvement strategies will be monitored by regional consortia which will then be well placed to identify common needs and design appropriate provision, such as facilitating the transfer of effective practice or the



provision of bespoke professional learning programmes. The Welsh Government is working closely with consortia on establishing consistent provision across all areas. Through the development of the revised Masters programme, the Welsh Government is also considering how this provision can provide opportunities at different career stages to improve the quality of classroom practice and of school leadership.

### **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

8. Enable all STEM teachers and lecturers to gain relevant experience of working in STEM businesses and industries.

### **Response: Accept**

We recognise the importance of ensuring that the STEM teaching workforce is alive to industry, scientific and technological developments. Programmes to develop this understanding are already in progress, as outlined below. However, the Welsh Government will continue work to enhance school employer links as a key area of business.

A significant number of STEM Ambassadors come from business and industry and can share their insight and experience with teaching staff, as well as children, when they speak in schools.

We outline a commitment in *Qualified for Life* to developing an enhanced employer engagement project to promote stronger employer-school links. We will procure an organisation to implement a model which will establish a more coordinated and sustainable approach to business engagement with schools – effectively setting up school-employer partnerships. Once the partnerships are established, we anticipate that a range of activities will be delivered based on school needs, and that closer partnership working will increase expectations and demand at school level for interactions with industry, through for example, STEM Ambassadors. Activities may include funding for short-term teacher placements or interim assignments in industry to raise awareness of industry and help enrich teaching. We aim to test the model in secondary schools during summer 2015 and roll out in autumn 2015.

We will also continue to make available financial incentives to encourage graduates with high levels of STEM subject knowledge to consider teaching as a career. This includes support for career changers with a background in industry. Employment-based routes to teacher training are also available, with targeted support towards the salary costs for those training to teach mathematics, chemistry, physics and computer science.

## Financial Implications

Additional costs from the enhanced school / employer engagement activities highlighted above will be drawn from existing programme budgets.

The Committee recommends that:

9. Develop a clear expectation of what the Welsh Government expects the higher education sector to be delivering for the STEM agenda: in the short term through the Minister's Annual Remit Letter to the Higher Education Funding Council for Wales, and in the longer term as part of the Government's response to the recommendations of the Review of Higher Education Funding and Student Finance Arrangements in Wales, led by Professor Sir Ian Diamond.

### Response: Accept

Our Higher Education Institutions already undertake work with schools as part of their third mission; and there are excellent examples of STEM activities targeting children, either through NSA funding, or HEIs' own resources. In addition, many Research Council grants require work to explain and present research to the wider public – much of which can be done for school pupils at various levels. However, I accept that a more structured and coherent approach would benefit the HEIs, schools and our young people.

That said, how HEFCW distributes its funding to the HE sector in areas such as research and post-graduate, STEM, and other higher-cost areas is a matter for the Council, not the Welsh Government. I am aware that the tuition fee reforms and the Welsh Government budget settlement mean that the Council have some difficult decisions to make, but I have made it clear to the Council that we need to aid transparency by communicating the impact on overall income levels of tuition fee reforms to help shape future debate.

Since the announcement of the tuition fee grant reforms, we have always been aware that HEFCW's funding formula would need to change to reflect the new funding regime. We have to be realistic and acknowledge that this means that HEFCW's relationship with the sector in Wales has and will continue to change. The majority of HEFCW funding is no longer distributed directly to universities, but is paid out in tuition fee grants to Welsh domiciled students. However, universities in Wales are better off under the new regime, and there should be an expectation on our institutions to accept that areas that were previously funded by HEFCW via specific funding streams might now be regarded as their responsibility, because the outcomes are important to Wales and to their own institutional ambitions. I would hope that this is the start of a partnership approach to delivering Welsh Government priorities in higher education, including a continued emphasis on the promotion of STEM subjects.

This new approach to delivery was highlighted in my remit letter to HEFCW this year. I will also ensure that the Committee's report is brought to the attention of the Diamond Review.

### **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

10. Publish a formal skills audit of supply and demand for STEM skills in Wales and compare that with the projected future needs of a growing and sustainable Welsh economy.

### **Response: Accept in principle**

STEM is taken into account in the wider work of the Labour Market Intelligence team. STEM needs were included, where appropriate, in the National Strategic Skills Audit for Wales 2012, published in February 2013. Additionally, all industries are discussed in the Working Futures series of reports, published by the UK Commission for Employment and Skills (UKCES). The latest report, Working Futures 2012-22, was published in March 2014. A summary report for Wales is currently in production. The supply and demand for STEM skills has been taken into account in internal projects, prepared for DEST and DfES. We are committed to improving the availability and use of Labour Market Intelligence in Wales (such as through the Learning and Skills Observatory website) and will continue to consider STEM skills in our future work.

### **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

11. Based on proven good practice, target more interventions at an early age to encourage girls to achieve their full potential in STEM but sustain those interventions over the long term until there is a gender balance in those subjects.

### **Response: Accept**

This is an area of key importance if we are to realise our ambitions that more of our young people progress into STEM-related learning and careers. The issue of sustained effort is recognised, particularly given the issue of societal attitudes in this area. We are keen that those sustained efforts should particularly target the areas of specific concern within STEM, such as girls' progression in mathematics and

physics. As with Recommendation 2 above, we need to ensure that our sustained efforts impact at each key stage of learning, starting at the earliest stages.

I have recently launched the *Qualified for Life: Focus on Science* campaign, which outlines gender as a key issue, across primary and secondary settings. This is also linked to our *Education Begins at Home* campaign, which seeks to engage parents more in the child's development. Schools, pupils and their parents need to better understand the value that STEM learning can offer girls in terms of rewarding careers at all levels, and not just for graduates.

The Chief Scientific Adviser for Wales has set up a 'Women in Science' task and finish group. This is meeting at present to try to address the 'leaky pipeline' which sees girls and women lost to long-term STEM careers over time. This starts with losing girls from ever starting to study science.

### **Financial Implications**

None. The additional costs for the campaign have been allocated to programme budgets following the First Minister's announcement on 16 June 2014.

The Committee recommends that:

12. Work with STEM employers to develop support structures for providing more flexible and family friendly working environments and support the work of the Chief Scientific Adviser in this area.

### **Response: Accept in principle**

The 'Women in Science' task and finish group will look at this issue as part of the wider enquiry into the 'leaky pipeline' of women lost to science careers. However, the group is unlikely to be looking at flexible/family friendly working in STEM industries in particular depth. The right to request flexible working is now part of UK law. It applies to STEM employers as much as to any other employer.

### **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

The Committee recommends that:

13. Ensure a joined-up approach so that the Welsh language is mainstreamed in strategies and policies to promote STEM.

### **Response: Accept**

The NSA will work with key partners that have a focus on supporting the teaching and learning of STEM subjects through the medium of Welsh. It provides funding support to schemes delivered through the Welsh language, and addresses Welsh language considerations in grant award letters, as a matter of course. Equally, my Department's funding of Techniquest and Techniquest Glyndŵr places a requirement on those organisations to ensure that the Welsh language is taken into account in planning and delivery.

A key element of the new *Qualified for Life: Focus on Science* campaign will be to support primary and secondary schools through the provision of more bilingual resources that promote awareness of and interest in science.

### **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.

### **Recommendation 14**

The Committee recommends that:

14. Address the lack of availability of STEM teaching materials in the medium of Welsh.

### **Response: Accept**

In October, the two new mathematics GCSE specifications and Sample Assessment Materials (SAMs) were published bilingually. Additional bilingual SAMs for mathematics have been commissioned from WJEC and bilingual Sample Teaching Materials (STMs) for the mathematics GCSEs have been commissioned by an external provider. The move to single mathematics GCSE specifications (and Science from 2016) for Wales allows for the development of targeted Welsh-medium resources – aimed at supporting qualifications which will be offered in all schools in Wales.

Bilingual educational support materials for STEM are being produced for use in schools and placed on the Learning Wales / Hwb websites for practitioners to access. The materials will include: Scientific literacy: a guide for Key Stage 4 teachers; Wales-produced PISA sample questions; OECD published science sample questions; STEM guidance; and a range of Key Stage 4 STEM materials on Hwb.

### **Financial Implications**

None. Any additional costs will be drawn from existing programme budgets.