

NAfW Enterprise and Business Committee - Follow-up Inquiry into Science, Technology, Engineering and Mathematics (STEM) Skills

The Institute of Mathematics, Physics and Computer Science at Aberystwyth University welcomes the opportunity to respond to the NAfW Enterprise and Business Committee Follow-up Inquiry into Science, Technology, Engineering and Mathematics (STEM) Skills. Mathematics, Physics and Computer Science are key STEM subjects that underpin the knowledge-based economy. Maximum benefit to the economy and society in Wales requires support for maintaining excellence in teaching and research and forging closer links between education and employers.

- ***What impact has the Welsh Government's strategy Science for Wales and Delivery Plan had on science, technology, engineering and mathematics (STEM) skills in Wales?***

At HE level, the most visible and welcome impact of the Science for Wales strategy is the establishment of the Sêr Cymru initiative and the National Research Networks. They have taken some time to be established, with much background negotiation, but their presence is now beginning to be felt. The networks have been built on existing partnerships and are aligned with strategic areas that resonate internationally. The networks are currently (2014 calls) supporting collaborative research teams of postgraduate students and research fellows aligned with the networks' priority themes.

It is perhaps too soon to see the benefit of these initiatives in terms of increased grant income and their implementation may be too late to have a major impact on REF2014. REF is subject-based and there is not always a direct match between REF units of assessment and the Welsh-funded networks in comparison with other regions and nations (e.g. in Physics and Chemistry in Scotland and England). There are some emerging areas of science and technology, not prominent in the NRNs, that are receiving priority elsewhere (e.g. RCUK, H2020) and where there exists expertise in Wales. These include Quantum Technology, Space Technology and Photonics – we hope that the growth and expansion of the Sêr Cymru and NRN initiatives is supported to include important new areas as they emerge.

While the new investment in these initiatives are welcome, we are concerned of a long term and increasing funding gap between Wales and the rest of the UK in HE funding, especially in STEM subjects. Some of the challenges faced by science HE departments in Wales include lower subject premiums for UG students (HEFCE circular: *Non-mainstream allocations to support very high-cost STEM subjects: Recalculation of allocations using most recent data* (2013)) and lower capital investment (e.g. £400M capital investment for STEM in English Universities announced in 2013). However, Wales is increasing its share of competitive research funding and competing well internationally (Learned Society of Wales report: *Recognising the Quality of Research at Universities in Wales* (2013)). This inevitably leads to comparatively lower overall resources to support HE STEM students in Wales that will have a long-term effect on the economy if not addressed.

- ***What progress has been made in addressing the issues identified in the Enterprise and Learning Committee's 2011 inquiry into the STEM agenda, including:***
 - ***The adequacy of provision of STEM skills in schools, further education colleges, higher education and work-based learning (including apprenticeships);***

Universities and professional bodies recognize the importance of strong links within the education sector (schools, FE and HE) and between educators and employers. Universities have resources that are of value to schools and colleges; e.g. lectures from experts in topical areas, role models (especially UG and PG students), access to laboratory facilities, summer university, training for teachers and work experience for students. At Aberystwyth we have, for example, hosted a training workshop for Welsh medium teachers in Mathematics and Physics. Awareness of funding opportunities could be improved and further initiatives should focus on engaging and rewarding individuals on both sides for taking initiatives, and should provide adequate travel and teaching cover funding for the partners.

- ***Value for money from 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;***

Our interaction with Welsh industry indicates a desire to interact more closely with the HE sector to ensure that we produce graduates that have the necessary skills. There are opportunities with summer placements, undergraduate projects and industry involvement in course delivery and skills training. Funding is helpful in initiating and sustaining dialogue, for example Knowledge Exchange projects, networking events, Open Innovation initiatives, and support of skills training e.g. HE-STEM funding for a Mathematics help desk for students and for engaging with the photonics industry via the UPSKILL project. The key factors are matching the right people on both sides and the development of relationships - these should be the focus of future initiatives.

- ***The supply of education 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;***

Support for teacher training is welcome; these are popular career choices for our graduates and essential for the success of the disciplines and the economy. It is important that the best students are encouraged into careers as teachers. At Aberystwyth, we have almost doubled the number of graduates in Mathematics and Physics since 2009; a higher percentage of graduates enter further study than for the subjects nationally or in comparison with other disciplines at Aberystwyth, and we have one of the highest current rates of good honours degree classifications within the university.

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

Government initiatives such as Knowledge Transfer Networks, Access to Masters, Academic Expertise for Business, etc. are an essential mediator of improved interaction, but there is often a duplication of effort and lack of communication. For example, numerous projects have compiled lists of expertise and facilities in recent years. It would perhaps be more effective if the drive were more from employers than universities, perhaps coordinated more strongly by industry-focused and led consortia such as the sector fora.

- ***Whether any progress has been made on addressing negative perceptions and gender stereotypes of STEM and promoting good practice to encourage women to acquire STEM skills and to follow STEM related careers.***

The university and the professional bodies recognize the disproportionate numbers of women studying some STEM subjects (e.g. the IOP has raised concern of physics at post 16 level) and in particular their lack of prominence in senior positions in academia and in industry. Aberystwyth University is carefully considering how to implement the recommendations of the House of Commons Science and Technology report "*Women in scientific careers*" (2014) and the CaSE "*Improving Diversity in STEM*" report launched by the Chancellor in May 2014. Both reports clearly identify the barriers experienced by women seeking to acquire scientific skills and progress their careers in STEM subjects. There is variation across disciplines and between countries with many cultural barriers to be removed. Key strategies include supporting role models and to provide a more flexible career path. At Aberystwyth, a range of positive actions have been identified to support the recruitment of female students into STEM, and to support their development from undergraduate onwards. The university's application for Athena SWAN Bronze award has support from all STEM departments and work has started on a detailed three-year action plan to support women in STEM. There was enthusiastic engagement by STEM departments in a series of International Women's Day events held in March 2014. We have appointed new lecturers in Physics and Computer Science, hosted lectures by successful graduates and have provided Welsh representation at the IOP's Diversity and Inclusion committee. The university's Centre for Widening Participation and Social Inclusion co-ordinates STEM awareness, supporting for example, initiatives led by our undergraduate students to encourage the take up of STEM subjects by girls.

- ***What progress has been made on learning STEM skills through Welsh medium education and training?***

Yn ganolog i ddatblygiad diweddar Cyfrwng Cymraeg yn y Prifysgolion mae cyd-weithio gyda'r Coleg Cymraeg Cenedlaethol. Yn Aberystwyth, mae hwn yn adeiladu ar y ddarpariaeth oedd eisoes ar gael mewn pynciau STEM megis Mathemateg a Ffiseg. Mae cefnogaeth y Coleg (e.e. ariannu swyddi a phrosiectau a sefydlu Paneli Pwnc) wedi helpu i greu strwythur cadarn ar gyfer cynllunio hir dymor (e.e. *Cynllun Datblygu Mathemateg a Ffiseg* gan Banel Gwyddorau Mathemategol a Ffisegol y CCC).

Credwn ei fod yn hollol bwysig bod cyfleodd ar gael ar draws y wlad i astudio pynciau STEM drwy'r Gymraeg. Bydd hyn yn sicrhau ein bod yn cynhyrchu graddedigion sy'n medru trafod pwnc ei harbenigaeth yn y ddwy iaith ac yn defnyddio'r Gymraeg yn naturiol mewn meysydd gwyddonol a technolegol. Mae manteision cyflogadwyedd dwyieithrwydd yn y sector preifat yn ogystal â'r sector cyhoeddus. Mae'n bwysig bod ein graddedigion gorau sy'n dymuno dysgu yn y sector addysg gynradd ac uwchradd yn gyfforddus yn defnyddio terminoleg gywir yn eu pynciau yn ogystal â bod yn arbenigwyr yn eu meysydd. Bydd hyn yn sicrhau bod dim cyswllt annaturiol rhwng dewis pynciau a gallu ieithyddol yn yr ysgolion.

Drwy gefnogaeth y Brifysgol a'r CCC, mae cynnydd sylweddol wedi bod yn y ddarpariaeth Mathemateg a Ffiseg a'r nifer sy'n dewis astudio'r pynciau drwy'r Gymraeg. Drwy'r ddarpariaeth, mae ein myfyrwyr yn gymwys i dderbyn Ysgoloriaethau Cymhelliant CCC (£500 y flwyddyn). Rydym wedi estyn y cydweithio i gynnwys Prifysgolion eraill (swyddi CCC newydd yng Nghaerdydd ac Abertawe) ac mewn Cyfrifiadureg o fewn ein hathrofa. Mae tri darlithydd CCC yn dysgu'r pynciau STEM yma yn Aberystwyth. Mae'r pwyslais wedi bod ar gynnig y pynciau yn ddwyieithog ac i gynyddu'r nifer o fodiwlau sydd ar gael. Mae twf cyson yn y nifer sy'n dewis modiwlau cyfrwng Cymraeg ers eu dechrau tua 2007 – eleni mae 56 o fyfyrwyr Mathemateg, Ffiseg a Chyfrifiadureg yn dewis astudio rhan o'u cwrs gradd yn y Gymraeg.