

# Defining a Regional STEM Strategy for the Dundee City & Angus Region

*Supporting an Integrated and Coherent STEM Strategy- 26 April 2017*





## Preface

This document represents the work of the STEM Foundation in conjunction with Dundee & Angus College to develop an interlinking STEM strategy for Dundee City and Angus region in Scotland, to support the needs of local schools, universities, industry and stakeholders. This will empower investment decisions on current and emerging skills needs reflecting local and regional economic priorities, thereby maximising the use of resources and driving regional growth in a sustainable way.

This STEM Strategy intends to be:

- **Connected:** creating synergy across the region to ensure sustainability and scalability of provision, and to ensure efficiency and effectiveness of delivery and reach across the areas where the region operates. The STEM strategy advocates the need for additional cross-curricula activities where innovation in curriculum development, enrichment, access and delivery by learners and employers can be further enhanced
- **Contextualised:** serving the local priorities and needs of employers and learners by providing contextualised STEM provision and solutions aligned to support the local economies and communities where the individual regions operate, and
- **Contemporary:** embracing horizon scanning to ensure new and emerging technology areas of economic growth are developed and curriculum is continuously nourished to support employer needs and learners' expectations.

You and your stakeholders will need to consider the recommendations within this STEM Regional Strategy to determine what success will look like in 3-5 years' time. This report will help to focus the development of Dundee & Angus regional 'STEM Pledges' and create a **Regional STEM Manifesto** to drive engagement with local and national employers and other stakeholders.

We thank you for working with us on this critical project, wish you every success with your implementation and look forward to working with you and your colleagues again on future initiatives.

**STEM Foundation, April 2017**



## 1. STEM Strategy Overview

This Regional STEM strategy outlines how the Dundee City and Angus region can create a unique collaboration between the College, schools, government agencies, councils and regional bodies and universities to maximise STEM education and build capacity, ensuring a skilled STEM workforce aligned to industry demand. This will develop the capability to deliver new and emerging technology provision that meets the needs of the key regional industry sectors.

The primary aims of the Dundee & Angus regional STEM strategy are to:

1. align the STEM provisions to strengthen and build up capacity in areas of key economic importance (pipeline alignment)
2. address weaknesses or gaps in provisions to meet employer needs and resolve deficiencies (e.g. career advice at the right time, gender bias)
3. develop the conditions for collaborative working in STEM to create collective value.

Dundee City and Angus region has fewer people in STEM Producing occupations (3.5% and 2.6% of the workforce) than the rest of Scotland, and England and Wales. Data also reveals that Dundee City has more people in STEM Dependent occupations than elsewhere (12.6% of the workforce), and Angus has more people that are in the STEM using occupations<sup>1</sup>.

Employers in the Dundee City and Angus region experience a degree of underemployment (a measure of labour-force utilisation); this includes those workers who are highly skilled but working in low paying jobs, workers who are highly skilled but working in low skill jobs and part-time workers who would prefer to be full time as well as those workers that are highly qualified but with economically under-demanded qualifications. Unemployment and skills gap in Dundee City is above the UK national average. Self-employment in Dundee City is also lower than the UK average. The low self-employment rates in Dundee City may represent a potential market for the college and partners by providing courses for the self-employment to improve their accounting and financial planning skills and encourage self-employment.

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<sup>1</sup> STEM Producing: scientists, engineers | STEM Dependent: Doctors, nurses, teachers | STEM Supporting: Technicians, associate professionals | STEM Using: Trades, welding, metal machining, vehicle, and construction



Major growth is expected in the economic areas of Professional and Support Services real estate, media and information technology and construction as well as the health care sectors. Replacement demand for labour will represent 94% per cent of new demand reflecting retirements of existing workers. Managerial, professional and associate professional jobs will constitute 49% of the overall demand, a slightly smaller proportion than the UK as a whole (54%).

There will be a net loss of jobs in all other occupational groups, with the exception of caring and elementary occupations (but still considerable replacement demand). Demand for all levels of qualification with the exception of SQA Level 7+, will be limited to replacement jobs, with the proportion of the workforce qualified at SQA Level 7 and above needing to grow significantly in the region from 46% to 60% by 2024.

Figure 1 highlights the six clusters as areas of potential growth that the college and its STEM partners will need to focus their efforts on in order to create the required baseline capability to drive and sustain growth in STEM related industries in Dundee City & Angus.

This Regional STEM strategy has been produced to align and provide synergy with the:

- Skills Development Scotland – **Regional Skills Assessment**<sup>2</sup>
- Education Scotland – **STEM agenda (STEM Central)**<sup>3</sup>,
- The **Tay Cities Deal** March 2017 (Tayside and Central Scotland)
- Scottish Government: *Developing Youth Workforce group (DYW)* – **Scotland's Youth Employment Strategy**<sup>4</sup>, and
- Scottish Government: *Science Technology Engineering and Mathematics Education Committee* – **Pillars and lintels: The what's, why's and how's of interdisciplinary learning in STEM education** white paper<sup>5</sup>.

<sup>2</sup> <http://www.skillsdevelopmentscotland.co.uk>

<sup>3</sup> <http://www.educationscotland.gov.uk/stemcentral/index.asp>

<sup>4</sup> <http://www.gov.scot/Resource/0046/00466386.pdf>

<sup>5</sup> <http://www.gov.scot/Topics/Education/Schools/curriculum/ACE/Science/STEMEC/STEMECPapers/PillarsandLintels>

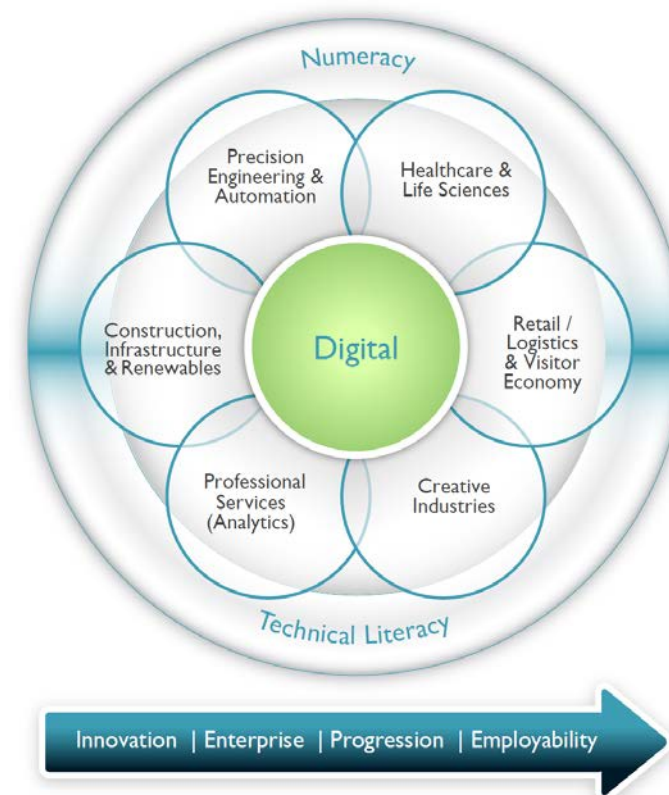


Figure 1: STEM Clusters for the Dundee City & Angus Region



## 2. Careers in STEM

A well-qualified STEM workforce is crucial to business and industry in the UK<sup>6</sup>.

Graduates in STEM subjects can expect to receive amongst the highest salaries of all new recruits. However, in repeated CBI surveys (2012, 2013 and 2014), 42% out of 500 employers reported having difficulties in recruiting STEM skilled staff. Many professional and sector bodies have also confirmed the severity of recruiting new staff by their member organisations.

STEM studies identify that individuals with analytical, numerical and problem solving skills are sought after by many sectors. Young people with STEM qualifications and competencies are thus better prepared for employment in a wide range of STEM and non-STEM sectors and jobs.

*“While four in five (80%) graduate jobs do not require a specific degree discipline, it is clear that studying STEM subjects gives students a competitive advantage in the labour market. When asked whether they prefer any particular degree subject when recruiting graduates, half of employers responded that they prefer those with STEM degrees.” (CBI)*

The greatest growing need for the STEM workforce is in professional technician roles. High-quality work-based training routes offer young people a strong foundation for their future careers and lifelong professional development.

*“Studying science and maths unlocks a range of employment opportunities for young people across the economy. Businesses are clear that government should take further action to promote these subjects, with two thirds (64%) wanting to see more done in schools and colleges to promote their study. Young people need access to high quality, impartial careers advice grounded in information about the jobs market to allow them to make informed choices about their future career. This must include advice about the vocational routes open to them – such as apprenticeships – as well as more traditional academic options.” (CBI)*

Having a range of experiences contribute to a young persons’ views of their potential future career pathways. Careers-related learning includes formal careers information, advice and guidance (AIG), informal careers information such as interactions with an employer during education or training and work experience, thus supporting the broadening of a young person’s view on STEM careers.

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<sup>6</sup> National STEM Careers – <http://www.nationalstemcentre.org.uk/stem-in-context/careers>



Therefore, it is important for the STEM education and training providers and stakeholders to enable young people to have access to high- quality careers information, advice and guidance thereby illustrating the rich range of career opportunities that STEM study opens up to them. Such career-related learning could be manifested through for example the following:

- *Activity within the curriculum, enhancement and enrichment opportunities, work experience, formal careers IAG with careers professionals, and informal discussions between teachers, students, and parents, all contribute to this experience*
- *Signposting STEM subject teachers to careers information for young people. Many professional bodies, educational charities and the UK Commission for Employment & Skills provide high- quality sources of information that teachers can direct their students to.*
- *Well-produced resources are available that teachers may integrate into their teaching in order to increase students' awareness of potential career routes. The 'Signposting links' page of this website is a starting point for further information (<https://opensource.com/education>).*





### 3. STEM Regional Partners

Participants on 26 April 2017 Facilitated Session included representatives from:

Abertay University

Angus Council

Angus Training Group Ltd

Dundee & Angus College

Dundee Children's University (DCU)

Dundee City Council

Dundee Science Centre (DSC)

Dundee University

DYW (Developing the Young Workforce) DA

Energy Skills Partnership

Scottish Funding Council

Skills Development Scotland



#### ABOUT THE REGIONAL STEM STRATEGY

The STEM Foundation, in collaboration with Dundee and Angus College is working to develop a **STEM Strategy for the Region** that will shape the STEM curriculum offer, improve engagement with employers and stakeholder and ensure coherency of STEM activity with schools, universities and other educational providers, thus creating the right capability to support areas of strategic economic importance.

#### Employer Demands Mapping in Dundee City & the Angus Region

We would like to invite you to complete this short questionnaire, as it will provide vital information that will be used on the day of the **STEM Regional Strategy Facilitated Meeting on 23 April 2017**, as well as being incorporated into shaping the final STEM Strategy for the region.

#### EMPLOYER

Name of Company: \_\_\_\_\_

Your Name: \_\_\_\_\_

Job Title: \_\_\_\_\_

1. When looking for new staff what are the big challenges (rate them in order of importance – 1 most important – 6 least important) 2
- A lack of:
- ☐ Digital Competency
  - ☐ Technical Expertise/Ability
  - ☐ Appropriate Experience
  - ☐ Professionalism/Attitude
  - ☐ Innovation & Problem-Solving Skills
  - ☐ Business Acumen

Some of STEM-related skills shortages identified include:

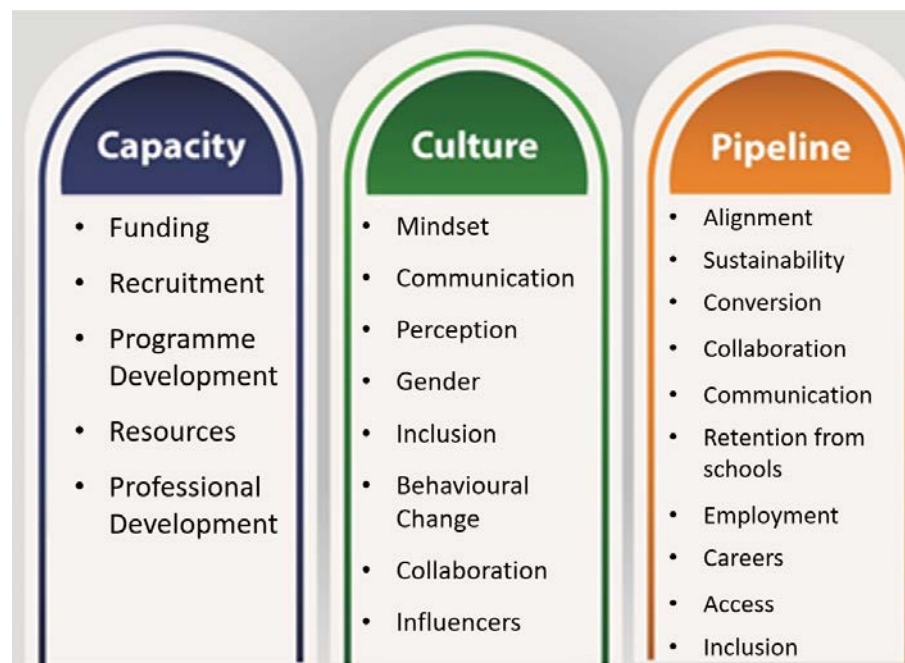
- Audiology and physical sciences
- Biomedical Engineering
- Digital
- Engineering and technical (mechanical, architectural, electrical power)
- English communication
- Mathematical principles
- Physics in relation to marine & underwater engineering
- Project Management
- Retail Management
- Software programming / software engineering
- Sonography radiology and medical imaging
- Supply Chain Management
- Transport Management



### 3.1 Summary of Regional Challenges

The challenges were clustered into three key impact groups: **Capacity**, **Culture** and **Pipeline** as shown in Figure 2.

- The Facilitated Session meeting has highlighted the schools' difficulty in accessing current STEM resources. The survey suggests that of the 20 differing new technologies expected by employers, only 6 were available in schools and these were available to only 20% of the learners. The college could look to expand the opportunities for schools' pupils to utilise their equipment. This may offer a new route to attract students that may wish to venture towards biotech, engineering and construction.
- The current STEM schools provision is also limited. It may be worth exploring the idea of creating an integrated plan for schools and the college. This collaborative approach could offer better approach to sharing resources, attracting funds and working with local employers.
- The schools and the college could share resources and ideas for cross-curricular teaching: for example, by sharing teachers who can lead on a scheme perhaps at each of the schools, by sharing equipment and spaces, by grouping learners across cohorts. Ensuring a clear pipeline from primary into secondary education to improve the quality of subject understanding will allow learning to be adapted and shaped to fit individual student's requirements.







- Development of a portfolio of real-life case studies will allow STEM curriculum to be contextualised and aid cross-curricular understanding. This will also aid careers advice.
- Development of STEM collaborative projects with the region that have multiple roles, subjects and expertise across different ages groups to explore creativity and broaden the understanding of STEM.
- Short industry placements as part of a teacher's professional development will provide an understanding of skills requirements and the breadth of STEM careers opportunities.
- Sharing of specialist technical staff between schools or delivery of science subjects in school by college lecturers ease this issue.
- There exists a vast array of "open source" educational resources online and through organisations such as The Science Learning Centres, Nuffield Foundation and the Wellcome Trust. These resources should be identified and structured in line with curriculum requirements to provide up to date and relevant content to improve the pedagogical experience of students.
- It would be worth considering the creation of a regional portal to track learner destinations. If created with all regional partners, schools, the college and universities it will provide a powerful way for all stakeholders to measure destination statistics and the impact of their provisions.



## 4. Supporting the STEM Regional Clusters: Recommendations & Suggestions

To ensure constructive alignment of inputs and participations, the following recommendations and suggestions have been identified:

### 3.1 Councils:

- Councils should form the **D&A STEM Partnership** to provide a **Forum** that brings together all the actors. The STEM clusters identified in the STEM Strategy should provide the basis of focusing the initial efforts.
- Councils across the region could create and sponsor a joined-up programme of **STEM innovation breakfast clubs** to spark new ideas and develop creative opportunities collaboratively.
- Councils could take a leadership and **coordinating** role in the provision of STEM career related information, advice and guidance by establishing a **“The D&A Career Guidance Working Group”** to steer this co-development opportunity.
- Councils should examine through a process of annual **horizon-scanning** (aggregating the data from the individual Councils) and in partnership with DYW, the current and future **STEM-related trends** to ensure market fit with the STEM provision.
- Councils should assume a facilitation role by forming **Action Learning Sets** (including online) that will enable collaborative participation by schools, the College and local universities to address key challenges such as: mathematics, employability skills, creativity and pipeline development (primary-secondary-FE-HE).
- Councils should leverage their enterprise development zones and clusters to **promote** the STEM skills and publicise the collective STEM capability, thus attracting employer interest and ultimately investments into the region to support growth in GVA.
- Identify and develop a **Directory of Resources & Facilities in STEM** to capitalise and maximise access for providers of STEM provision across the region.



### 3.2 Schools

- Schools will need to be encouraged to actively participate in outreach activities with the College, local universities and businesses to build **better understanding of career** opportunities and routes into STEM.
- Schools should make a **visible commitment** to enhancing the **mathematical understanding** and competency of learners that are entering different further and higher education levels by providing **contextualized resources** and industry based case studies (and the use of Core Maths).
- Schools should make an effort to include computational theory/thinking into the Curriculum to underpin the core technical problem-solving/maths/science and programming skills that pupils will need further in their educational journey. Google for Education has provided a suite of resources (130 lesson plans) to teach Computational Thinking and which is aligned to the Primary and Secondary education in the UK. More information and access to the resources here: <https://edu.google.com/resources/programs/exploring-computational-thinking/#!home>
- Schools will need to ensure that pupils receive sufficient, relevant **cross-curricular exposure** including opportunities to mix with learners from different curriculum areas.
- Schools should **explore using graduates** from further and higher education providers from across the region as teachers to **develop resources** to support the delivery of employability skills and STEM based subjects (for primary and secondary teachers).

### 3.3 The College

- Implement the **STEM Strategy** and publish the **STEM Manifesto** highlighting the key pledges
  - Identify STEM Coordinator and Cluster Leads
  - Implement the recommended CRM structure for employer & sector classifications
  - Establish Employer SIGs for each of the STEM clusters in the strategy
  - Commence development of newly recommended programmes
- Drive a technical **CPD** programme to upskill lecturing staff in new and emerging technology areas related to new provision offering – in partnership with key stakeholders (e.g. local universities, STEM employers, Dundee Science Centre, Energy Skills Partnership etc.)
- Compile and deliver a structured (age-group focused) and systematic (throughout the year) **STEM communication plan**



- Extend the '**Learning Passport**' offered by DCU to include STEM technical and professional focus to underpin the employability skills (e.g. technical communication, project management, dexterity).

### 3.4 Universities

- Offer specific '**Teacher Training Days**' in new and emerging technology areas to upskill college lecturers & school teachers, complementary to the DSC's 'Meet the Expert' programme
- Provide **rapid, flexible and cost effective accreditation** service that will enable colleges to develop and validate HNDs and Fds beyond the existing articulation routes
- Extend the '**Numerate Campus**' (based at Dundee University) to the D&A STEM Partnership so that colleges and schools can benefit from this enhancement intervention
- Make STEM related **resources & facilities available** (where practicable) to college/school teachers and lecturers during unscheduled timetable hours
- Universities and the College should establish a joined-up **D&A region Alumni Service** to leverage their past graduates in offering STEM activities (e.g. keynotes, case studies, placements etc.)

### 3.5 STEM-Related Employers

- Contribute directly and/or through representative bodies (EEF, Chambers, ESP etc.) to the development of the regional STEM capability through:
  - Participating in course development SIGs around the STEM Clusters
  - Offering placement opportunities for teachers and students
  - Sponsoring Apprentices
  - Providing case studies, guest lecturers
  - Advising on industry standards and practices



- Donating equipment and offering guidance on procurement of technical equipment
- Mentoring on STEM career opportunities and changes in STEM job families

### 3.6 D&A STEM Partnership

To galvanise the participation of partners through open innovation and encourage a co-creative environment, the following example activities should be considered:

- The D&A STEM Partnership could consider the creation of a *hack-a-thon* **competition** which all members (including councils, employers, universities and other stakeholders) could co-sponsor, which could be focused on, for example, the development of a mobile/smart phone app to promote and sign-post STEM businesses to the D & A region or consider a project around the growingly important area of Cybersecurity.
- Create a **collaborative project** to bring DSC, DCU and DYW together with employers, the college, schools and universities. A potential project (given the regional focus of biosciences and medical) would be to develop with **NHS Scotland an MA in Medical Technologies**, that includes employability skills, work-based content, digital content, together with progression/guidance on NHS career paths in MediTech areas. This would address a skills-gap that the NHS is currently facing.



## 5. Implementing the STEM Regional Strategy – Guiding Principles

The proposed D&A STEM Partnership has a great opportunity to collaborate in implementing the regional STEM strategy. There are seven key STEM clusters (highlighted in Figure 1) that have been identified for the Dundee City and Angus region that should be addressed as part of the key pledges in the D&A STEM regional manifesto. An agreed time line and responsibilities will need to be set and actioned. The following guiding principles should be considered to provide a steer to ensure constructive alignment of inputs and participation:

- Inspire all young people
- Build strong links with employers
- Widen access to advice on options on STEM (for all- this includes learners with learning disabilities)
- Face to face advice and guidance
- Work to create a partnership with and across the local authorities / councils
- Provide information about financial support and develop a smooth pathway between education and employment.

