

North West STEM Action Plan



March 2015



Contents

Executive Summary	3
1.0 Introduction	4
2.0 Context	8
2.1 Report of the STEM Summary (2009)	10
2.2 Success through STEM Summary (2011)	12
2.3 Success through STEM - One Year On (2012)	13
2.4 Addressing Gender Balance – Reaping the Gender Dividend	14
2.5 Progress to date	15
3.0 STEM Problem Statement	17
3.1 Science	17
3.2 Technology	19
3.3 Engineering	20
3.4 Mathematics	22
4.0 A Focus on the North West	24
4.1 Key priorities	24
5.0 Priority areas	26
6.0 Conclusion and moving forward	27
7.0 Action Plan	28
8.0 Priority Areas	29
Priority Area 1: Schools, Parents and Community Engagement	29
Priority Area 2: Further Education	32
Priority Area 3: Higher Education	34
Priority Area 4: Showcasing local innovation	35
Appendix A: STEM Reports Commissioned By the Department for Employment and Learning (DEL) and The Department Of Education (DE)	36
Bibliography.....	41

Executive Summary

When it comes to creating opportunities for economic growth in the future there are no more important areas than Science, Technology, Engineering and Mathematics (STEM). Our computer scientists, technicians and engineers can transform our world, pushing back the boundaries and expanding our horizons. Industry, both locally and nationally, is crying out for those with STEM skills. Indeed, in today's UK workforce, some 72 per cent of businesses rely on people with STEM skills. That figure is only likely to grow.

Our task then is to enthuse our children, develop their awareness of the vast potential of STEM subjects and support our educators and business people to develop a positive environment in which STEM can flourish.

The North West STEM Action Plan will create the framework for this approach, providing a context for STEM in Northern Ireland as a whole, while focusing on the key priorities for the North West, which includes the new Derry City and Strabane District Council Area. A road map to co-ordinate STEM activities across the North West, it aims to dramatically increase the number of young people studying and pursuing careers in STEM related subjects here.

With world leading STEM related academic and research centres, such as the Intelligent Systems Research Centre and C-TRIC, already thriving in the region, the Action Plan aims to grow the uptake of STEM subjects within primary, post primary and tertiary education while also building the capacity of the private sector to research and innovate.

Recent statistics show that the decline in the take-up of STEM related subjects is finally beginning to reverse but much needs to be done to accentuate this trend. There are several problems we must overcome in each STEM related subject. These include the fact that our post primary students are not required to study any science beyond age 14, while the numbers currently studying physical sciences at A-level is declining. We need to attract more females to subjects like engineering where the gender imbalance remains stark and make sure our numeracy and literacy levels rise.

Northern Ireland needs more than 1,900 new technology professionals each year, filling increasingly complex, high value-added roles. Yet industry has great difficulty filling these positions. We need a co-ordinated plan to create an environment where the North West is at the forefront of a transformation of attitudes towards the take-up of STEM related subjects.

The North West STEM Action Plan has identified three priority areas where agreed action plans can deliver positive change: -

- Schools, Community and Parental Engagement
- Developing Further Education
- Developing Higher Education

1.0 Introduction

“A workforce skilled in science, technology, engineering and maths is fundamental to Northern Ireland’s future competitiveness and wealth creation potential. Inspiring our young people to study these subjects and then choose a career in these areas requires a collaborative effort between Government and STEM companies.”

Dr Stephen Farry MLA, Minister for Employment and Learning

“Our nation’s future depends on our building today the right skills to meet the unprecedented challenges facing us. At the heart of that challenge is the need for a well-educated, well-motivated and inspirational cadre of graduates in the key areas of science, technology, engineering and mathematics (STEM).” (National STEM Centre, 2011)

Lord Willis of Knaresborough, House of Lords

“We want to make sure that we are exciting young people around maths and science and technology and computer science. We don’t want our kids just to be consumers of the amazing things that science generates; we want them to be producers as well. And we want to make sure that those who historically have not participated in the sciences as robustly ... girls, members of minority groups ... that they are encouraged as well. We’ve got to make sure that we’re training great calculus and biology teachers, and encouraging students to keep up with their physics and chemistry classes.... It means teaching proper research methods and encouraging young people to challenge accepted knowledge.” (Office of the Press Secretary, 2013)

President Barack Obama, President of the United States





Right around the world, leading figures have highlighted both the importance of STEM (Science, Technology, Engineering and Mathematics) as a key driver for the global and regional economy and also the need to ensure that it remains a key priority so that we can continue to grow our STEM talent pool and our economy.

Innovative science, engineering and technology have made a huge contribution to our industrial heritage, culture and wellbeing and we will need new generations of ambitious young scientists and engineers to drive the innovative technologies that will secure our economic success in the future. We need a scientifically literate population of well-informed and responsible citizens to drive forward our economic ambitions, improve our natural and living environments and deliver our climate change targets.

Our young people are growing up surrounded by technological innovation and their lives are increasingly influenced and enriched by science and engineering in ways in which they may not even be aware. Their lives will also be enriched by breakthroughs in medical science and technology and by scientific advances as yet unimagined. They will need to be equipped with increasingly complex and sophisticated technical and cognitive skills in order to take advantage of the challenges and opportunities that will confront them throughout their working lives.

The future prosperity of the Northern Ireland economy is largely dependent on the uptake of STEM related subjects at post primary and tertiary levels. STEM opens doors to a rich diversity of opportunities for young people. It can improve the quality of peoples' lives and find solutions to global challenges, such as sustainable economic, environmental and social development. STEM is crucial to developing our research and innovation capacity and enabling our businesses to grow, be competitive and increase productivity.

As a city we have a vast STEM talent pool that spans the generations and includes a range of innovations. The city and region gave birth to Lycra and the buzz bar and is also home to the smallest computer head in the world, thanks to the research centre located at Seagate. We have developed research excellence in life and health sciences at C-TRIC and in robotics at the Intelligent Systems Research Centre at Ulster University at Magee. New research to improve efficiencies and effectiveness is vital to our agri-food industry.

STEAM Based Learning

The addition of art and creativity, the idea behind STEAM (Science, Technology, Engineering, Art and Mathematics) based learning, encourages children to become more engaged with the core STEM subjects. STEAM based approaches can widen the talent pool, deepen the interest and encourage a real-world, multi-disciplinary approach to learning that is skills focused and develops both a rounded workforce and increased levels of scientific literacy.



STEAM Subjects

The North West was one of the first regions in the UK or Ireland to adopt STEAM based approaches to learning on these islands. Derry~Londonderry hosted the Future Classrooms 2014 event, 'Creating STEAM in the Classroom', with speakers from Rhode Island School of Design, who have led the STEAM movement in the USA. Several schools in the city are now delivering STEAM based programmes and have invested in resources like 3D printers and laser cutters to support in-school delivery.

Focusing on STEM locally, this North West STEM Action Plan builds on a number of studies which examine STEM activity in Northern Ireland as well as government reports and strategies. Its aim is to outline the best way to deliver STEM related education in the North West.

The purpose of North West Action Plan is to: -

- Provide context and background on STEM in Northern Ireland;
- Highlight problems with STEM in Northern Ireland;
- Detail a problem statement for each STEM subject;
- Focus on the North West, highlighting key priorities for the area;
- Identify areas of priority, including schools and community engagement activity, business engagement and further education and employer engagement;
- Promote STEM related events through a comprehensive and coordinated calendar, which provides information on key local and national STEM related events and creates a resource for primary, post primary and tertiary education providers.



Case Study: The Curve

Access and Lifelong Learning at Letterkenny Institute of Technology (LYIT)

The Curve was established in 2001 to co-ordinate strategic initiatives which help people return to or continue with support in college at LYIT.

The philosophy of the Curve is to work with people “wherever they are at” and support them to achieve their educational goals. Thus, we are continuously challenging ourselves to reach back to engage with children at pre-school, primary and post-primary with a view to putting in place pathways which will ultimately lead to third level education. But that is not all - simultaneously through Lifelong Learning we are also creating second chance opportunities for adults returning to education, so no matter what stage you are at in life there is something for you in the Curve. To make such an all-encompassing philosophy a reality we are fortunate to work with numerous agencies and people dedicated to making education happen in the North West and we acknowledge their continued support.

One of our flagship initiatives for people returning to education is our Preparatory Studies Programme which has helped over 2000 students return to college over the past 14 years. This course allows students to build a strong foundation in Maths and Communications whilst also exploring STEAM modules with a view to progressing on to mainstream courses after their year’s re-introduction to study.

The Curve - Including and supporting all learners at LYIT

The Maths Learning Centre (MLC) supports students who seek additional help with maths across all STEM subject areas. In keeping with the Curve’s ethos, students may avail of this support irrespective of their personal educational goals. Some students are aiming for 100% while others are merely looking to pass exams. Both groups are equally welcome!

The Communications Learning Centre (CLC) is dedicated to supporting students who want help with study skills, academic writing skills, giving presentations and of course exam preparation. The CLC is the “A” in the colleges’ STEAM agenda. At the Curve we also pride ourselves on supporting students with disabilities. At the beginning of every year we screen all students to assess their learning style and identify any learning difficulty they might have. Thereafter, we follow up by offering students the appropriate support they require.

The Curve - being part of the community

LYIT is the lead partner in the countywide reading initiative for primary and post-primary school children through an initiative called “Read DL”. We are particularly excited about this year’s initiative as it combines both the importance of reading with issues that arise for people with disabilities. This year’s book is “Wonder” by R.J. Palacio, which is already a best seller worldwide. The Curve also gets involved with the Business in the Community programme (BITC), which is a national initiative to bring the world of work/employment closer to senior cycle students at school. Currently we are working through BITC with over 50 students in 2 post-primary schools at opposite ends of County Donegal. See www.bitc.ie.

2.0 Context

The need for the North West STEM Action Plan is supported by several government reports, which also provide its context.

The Programme for Government (PfG) sets out the government’s spending commitments for the period 2011-2015 and is supported by the Northern Ireland Economic Strategy. The report identifies the importance of STEM in developing its vision for a competitive Northern Irish economy. This vision is based on a sustainable and growing private sector with a highly skilled and flexible workforce operating in productive and innovative firms that are competitive in global markets. The strategy identified the need to rebuild the Northern Ireland labour market following the impact of the global economic downturn, while also continuing to rebalance the economy.

Research and development, innovation and the skills of the workforce will be the key drivers of a competitive economy. The PfG identifies 82 commitments and commits to increasing uptake in economically relevant STEM places at further and higher education. The Department of Trade and Investment (DETI) commits to raising levels of employment by supporting the promotion of over 25,000 new jobs (Northern Ireland Executive, 2014). In order to deliver this commitment it is essential the workforce are equipped with the skills for the modern economy.

Similarly, the Northern Ireland Economic Strategy (Northern Ireland Executive, 2011) focuses on rebuilding and rebalancing the economy. In order to achieve this the Executive commits to:

- Stimulate innovation, research, development and creativity so that it can widen and deepen the export base;
- Improve the skills and employability of the entire workforce so that people can progress up the skills ladder, thereby delivering higher productivity and increased social inclusion;
- Increase skills in subject areas important to the Northern Ireland economy such as STEM and sales and marketing.

Both the Programme for Government and the Northern Ireland Economic Strategy correspond to the recommendations from the MATRIX panel (MATRIX, 2008), whose first report states that while STEM has the greatest potential to lead to economic growth a steady supply of people with STEM qualifications is needed to achieve this.





In aiming to grow interest in STEM, the Executive's Economic and Jobs Initiative (Northern Ireland Executive, 2012), which pledges to support the improvement of our capabilities in key areas such as STEM subjects, commits the Executive to a number of actions which focus on STEM awareness and uptake. These include: -

- Funding an additional 500 undergraduate STEM places each year, bringing the total increase in STEM places to 1,200 by 2015. This will enhance the skills base in priority areas for the Northern Ireland economy.
- Enhancing higher level skills and research capabilities in priority areas by providing 150 additional PhD places in 2013/14, 2014/15 & 2015/16 and providing additional resources to enable the further education sector to deliver an additional 600 enrolments during each of the next 2 academic years.
- Creating a bursary fund which will pay for up to 20 new graduates and employees to study Masters (MSc) level degrees in aerospace engineering.

The Northern Ireland STEM Strategy known as 'Success through STEM' aims to help empower future generations through STEM to grow a dynamic, innovative economy. Commissioned by the Department for Employment and Learning (DEL) and the Department of Education (DE), the STEM strategy is the government's response to the three reports outlined below, which are summarised in this section. A detailed review of these reports is provided in Appendix A.

- 'Report of the STEM Review (2009)' (Department for Employment and Learning and the Department of Education, 2009).
- 'Success through STEM (2011)' (Department for Employment and Learning and the Department of Education, 2011).
- 'Advanced Manufacturing and Engineering Skills' - DEL 2014.
- Addressing Gender Imbalance - Reaping the Gender Dividend in STEM (STEM Business Group November 2013 - Equality Commission).



2.1 Report of the STEM Review (2009)

The review of STEM 2009 by DEL and DE, noted that, as in many other developed countries, our young people are increasingly disengaged from studying STEM subjects. Known as ‘STEM fatigue’ this trend occurs right the way through the educational system, from primary school to university. This, in turn, has a very negative impact on companies seeking to recruit STEM talent and, consequently, on our future economic growth.

The review looked at the constraints and losses at each stage in the STEM artery. In addition to the general decline in the uptake of STEM subjects, it noted that there are several elements which are unique to Northern Ireland. For example, there is little planning at the primary/post primary school interface in STEM, thus restricting pupils’ progression at Key Stage 3. Furthermore, the relevant Continuing Professional Development (CPD) undertaken by teachers and lecturers appears to be very limited. From a careers perspective, insufficient time is allocated to planning for providing careers guidance in the majority of schools.

The report also notes that while the uptake of STEM subjects within further education has increased in overall terms, there is an ongoing decline in certain STEM subjects which are vital for economic growth. There are also concerns about the success rate in certain subject areas within FE, while the gender imbalance in engineering and IT/computing is markedly worse than the UK average.

Northern Ireland’s performance in science at GCSE in international assessments is good when compared with other countries. However, it has the largest spread between the higher and lower performing pupils of any of the countries assessed. There has also been a significant change in the past decade in the way in which young people combine STEM subjects at A-Level. This appears to reflect a bias towards professions such as medicine or those allied to it like physiotherapy, occupational therapy and radiography. The uptake of physical sciences at A-Level is also declining. The review also observed that between 10% and 18% of STEM students at universities in Northern Ireland drop out at the end of the first year. Migration loss remains a major issue with around 26% of NI domiciled students who graduate in STEM courses in the UK each year choosing not to live and work here following graduation. This makes it harder for local businesses to attract suitably qualified young people.

The review recognised that STEM has not been as high on the agenda in Northern Ireland as other regions in the UK and ROI and stressed that this must change and the importance of STEM prioritised in order for goals and targets in the Programme for Government to be met.

The review made a number of key recommendations: -

- Business must take a lead in promoting STEM;
- There needs to be increasing flexibility in the provision of STEM education;
- Government must better co-ordinate its support for STEM.

The review stressed that we must find ways to attract our young people into STEM education and ultimately into STEM careers. We must provide STEM education which fulfils the following three main functions if it is to equip young people to be active members of society:

- All pupils need to be equipped with the knowledge, skills and aptitudes required to engage purposefully with science related issues they will encounter in a society increasingly shaped by scientific and technological advance – STEM literacy;
- Many pupils need to gain further and higher education STEM qualifications and the skills required for an increasingly STEM based business environment;
- A significant number of young people need to gain the world-class skills required to invent and create STEM businesses here. STEM is therefore vital to growing a dynamic and innovative entrepreneurship-led economy.

The NI Executive is committed to growing the number of people studying STEM subjects in the post 16 cohort as well as increasing the number of students, especially those from disadvantaged communities, at graduate and post graduate level studying STEM subjects. This commitment has been reflected in the Programme for Government (Northern Ireland Executive, 2014) and the Northern Ireland Skills Strategy (Department for Employment and Learning, 2006). This is vital if we want to further develop the research and innovation capacity of the region.



2.2 Success through STEM Summary (2011)

'Success through STEM' is the cross-departmental strategy led by the Department for Employment and Learning and the Department for Education. The strategy focuses on three areas identified as priorities for the Northern Ireland Executive to take forward in the short term: -

1. Coordinating Business Links.
2. Managing STEM Sector Attractiveness.
3. Facilitating STEM Continuous Professional Development.

As reflected in 'Success through STEM - One Year On', considerable progress has been made. A number of cross-departmental working groups have been established and a NI STEM Business Co-ordinator has been appointed to support the work of the STEM Business Sub Group. Work has progressed with the Equality Commission to explore the gender imbalance. This has resulted in the launch of a STEM business charter and a good practice guide on addressing the gender imbalance. It is also very important to note that recent statistical evidence reveals that the STEM decline is starting to reverse. In 2012/13, 46% of Northern Ireland domiciled students at UK HEIs were studying a Science, Technology, Engineering or Maths (Broad STEM) related subject and 23% a narrow STEM rated subject (Department for Employment and Learning, 2013).



Case Study: School Employer Connections

School Employer Connections has provided work related learning opportunities for young people in secondary education throughout the north and west of Northern Ireland for almost 15 years. Their three core programmes are Work Experience, Class Programme and Events Programme.

SEC continue to deliver work related learning opportunities laid out in DENI's "Preparing for Success" strategy, providing appropriate experiences of the world of work. SEC deliver the vision the Education Minister set out in 2009 "to ensure that every young person has equal opportunity to reach his or her full potential".

SEC strive to achieve the aims of effective Careers Education Information Advice and Guidance (CEAIG) provision: developing each young person's self-awareness and skills; enhancing each young person's career exploration and practically supporting their career management. SEC offer a key resource supporting schools and employers in preparing young people for the world of work and enabling them to make more informed career choices.

School Employer Connections also creates an environment for employers to contribute to STEM education, translating the curriculum into terms that the employer can understand and deliver on easily. Our Class Programme has enabled employers to up-skill their staff in STEM education to a point where knowledge and expertise are utilised for the benefit of educating our students, who are the workforce of the future. This enables our students to envisage their futures in STEM careers.



2.3 Advanced Manufacturing and Engineering Services Skills – DEL (December 2013)

A key finding of this report, commissioned by the Department for Employment and Learning, is that advanced manufacturing and engineering companies have experienced difficulties in filling skilled positions over the last 2 years. These companies expressed concerns that the quality of graduate engineers coming out of university did not meet their needs. Problems identified include their lack of experience, poor problem solving and poor organisational and project management skills.

A number of key areas were highlighted for development: -

- Information on education/career pathways for advanced manufacturing jobs is needed so that parents/young people can be aware of the subjects to study and the different paths to be taken to increase chances of success in getting employment in the different areas of engineering. Salary information and progression data should also be available. It notes that this information should be provided well before decisions are made at GCSE level;
- Further work is needed to promote the sector to girls;
- Students and their parents should be provided with information about the apprenticeship route;
- Remuneration within the engineering sector impacts on the sector's attractiveness to new entrants, particularly when compared to other occupations and other regions;
- Perceptions of engineering held by parents and young people needs to be addressed;
- Engagement with the primary education sector continued through to pre GCSE age;
- Provision of bursaries to attract young people into undergraduate study in engineering;
- Talent retention within the region.

These are important considerations that must be addressed within the NW STEM action plan.



2.4 Addressing Gender Balance - Reaping the Gender Dividend - Equality Commission 2014

This report examines the gender imbalance within STEM education and in industry.

Although the gender balance at GCSE level (based on 2011/12) across all STEM subjects is fairly even, with girls making up 45.7% of pupils taking STEM subjects, the gender bias is more apparent within particular subjects, such as Physics (37.6% girls) and Design And Technology (22.8% girls). The one STEM subject area where there was a slight bias towards girls (52%) was Double Award Science. Of those girls that took GCSE STEM subjects, 76.3% achieved the higher A* - C grades compared with 75.6% of boys.

At A-level (based on 2011/12) the gender balance is fairly even, with girls making up 47.3% of pupils studying all STEM subjects. Only Biology (60%), Chemistry (55%) and Psychology (75%) are studied more by girls than boys. Physics (31%), Mathematics (43%), Further Maths (25%), Design and Technology (25%), and Computer/IT related subjects (approximately 41%) are subjects where the gender balance bias is most marked. Of those girls that took A-Level STEM subjects 85.4% achieved higher A* - C grades compared to 82.8% boys. This difference is more marked in Physics where 83.9% of girls achieved grade A*-C compared with 78.7% of boys. Physics, however, is one of the least favoured choices for girls, although there has been an increase of 16% in the number of girls taking Physics since 07/08.

The report notes that female school leavers tend to be better qualified than males: -

- 68% of females achieved at least 5 GCSEs at grades A* to C, including English and Maths, compared with only 56% of males;
- 64% of females left school with 3 or more A-levels compared with only 47% of males.

More females also progress to further or higher education: -

- 83% of females progressed to further or higher education, compared with 71% of males;
- 62% of 16-year-old school leavers are male.

However, the report notes that females only account for 29.8% of those graduating from higher education in STEM subjects and more males tend to study STEM subjects, particularly computer science, engineering and technology. This also tends to be reflected in the workplace where only 8.6% of those undertaking apprenticeships in STEM related areas are female and only a fifth of ICT managers are women. In the engineering sector males outnumber women by 9 to 1. It also found that twice as many men hold senior management positions as their female counterparts.

The report identifies good practice guidelines for employers to help address the gender gap covering the following areas: -

- Role models – prior to recruitment;
- Supportive personnel practices;
- Networking;
- Career Development;
- Mentoring;
- Role models – post recruitment;
- Monitoring progress.

Addressing the gender bias is one of the recommendations of the Success through STEM Strategy, which the STEM Business subgroup was assigned to implement.

2.5 Progress to date

In November 2012, the Department for Employment and Learning provided the funding to resource, as a secondee, the post of STEM Business Co-ordinator to support the work of the STEM Business subgroup.

In June 2013, STEM Business subgroup, in partnership with the Equality Commission, ran a seminar in June 2013 called 'Are You Getting The Balance Right - Is Gender An Issue For You?' At that seminar a draft report called Addressing Gender Balance - Reaping The Gender Dividend in STEM was discussed. That report contained the business case for gender equality, information about STEM charters, including questions about one for Northern Ireland, and 22 good practice guidelines.

Feedback was taken from the 70 people who attended the seminar about both the charter and the guidelines. Businesses were consulted about the elements of the report over the summer and seven case studies were gathered from different organisations including Schrader, Schlumberger, Allstate NI, Atkins and Ulster Bank. The STEM Business Subgroup launched the final report in November 2013. Rather than simply restating the problem, this report features suggestions for good practice to help provide solutions to the issue of gender imbalance.

Working with the Equality Commission, the STEM Business Subgroup launched the final **STEM Charter** in June 2014. In September many of the employers who signed up to the STEM Business Charter met for the first meeting of the STEM Employers Equality Network (SEEN). The network, run jointly by the STEM Business Group and the Equality Commission, asked the business representatives attending to identify which areas of the good practice guideline they wish to examine further. The next few meetings will address the use of mentoring, networking and challenging unconscious bias as possible methods to improve gender balance in STEM organisations.

Work is ongoing with the Equality Commission and Ilex to determine the potential for a North West launch of the STEM Charter and a North West version of the STEM Employers Equality Network. Some organisations with a presence in the North West have already signed the supplement, including Seagate, Allstate NI and the University of Ulster.

The STEM Business Subgroup was also charged to 'develop a clear STEM careers path'. Over the last year, the STEM Business Subgroup has published three STEM Supplements in the Belfast Telegraph, Irish News and News Letter. Several of the articles featured profiles of STEM Professionals, many of them female, to encourage parents, teachers and young people to consider the STEM options for careers and courses. The most recent one featured the Digital Derry map in the centre pages article, which was entitled 'World class STEM opportunities across Northern Ireland'. Several profiles of STEM professionals from the North West were also included.

Case Study: STEM Aware CIC

STEM Aware CIC is a non-profit social enterprise that facilitates and coordinates STEM (Science, Technology, Engineering and Maths) activities and workshops with a creative and innovative approach. The mission behind STEM Aware is to encourage 'every child' to engage in the world of STEM from an early age right through to career choices.

Although many schools deliver STEM at some level, STEM Aware actions itself to creatively make learners and educators interactively aware of STEM. It is the passion behind STEM Aware that believes any and every child has potential to thrive in scientific enquiry and the strength of engineering.

STEM Aware events are delivered within primary and secondary schools and at community events, including career days and STEM cross-curricular support programs, classroom lessons, afterschool clubs and family fun evenings and summer schemes.

STEM Aware events are relevant to current industry, alongside the educational curriculum allowing for children and young people to experience 'learning by doing' real life challenges by problem solving and applying creativity. The gender, nor ability, nor the social background of any child should dictate the opportunities that they are to experience through life.



Wind Turbines at Primary School



Robocup at Aspire



Bridge Building at Summer STEAM



Greenpower Goblin Car at NW SciFest



Making our own slime and bouncy balls



Making kites and flying them at Ebrington Square



Movie making on at trip to Foyle Valley Railway Museum during IT summer scheme



Cross-curricular STEM Program



Primary School feeder day



Crest Awards

Contact Details:

Email: info@stemaware.com Tel: 07713598617 (Roisin)
Web: www.stemaware.com Tel: 07890740330 (Paul)

 STEM Aware

 @STEMAware

3.0 STEM Problem Statement

It is clear that the regional economy needs a constant supply of school leavers, graduates and postgraduates with the necessary STEM skills in order to prosper. However, local companies are finding it difficult to recruit the STEM professionals they need to compete in today's ever changing business environment. Many local businesses have had to recruit from outside Northern Ireland to get suitably qualified and experienced graduates and many are choosing not to recruit, which impacts negatively on their growth and productivity.

In order to create and maintain the attractiveness and uptake of STEM, this section aims to highlight the main trends and areas of concern associated within each STEM subject.

3.1 Science

Students need to be equipped with the knowledge, skills and aptitudes required to engage purposefully with the science-related issues they will encounter in a society increasingly shaped by scientific and technological advance (Department for Employment and Learning and the Department of Education, 2009). However, research shows a clear decline in pupils' interest in science during the primary years, which is a major concern. This concern is further exacerbated by the fact that Northern Ireland pupils are not required to study any science beyond the age of 14. Science is not on the curriculum at all at primary level and young people are only required to be taught this subject for 3 years (from Year 8 to Year 10). The seriousness of this issue is reflected by calls for a high level science steering committee to lead a science strategy (Northern Ireland Assembly, 2012). This emanates from the Northern Ireland Report on the Committee's Inquiry into Developing the Northern Ireland Economy through Innovation, Research & Development and the Association for Science Education.

A number of issues have been highlighted: -

- Our performance in science at GCSE level in international student assessments is good, although we have the largest spread between the higher and lower performing pupils of any country assessed. This assessment was carried out in 2012 by the Programme for International Student Assessment (PISA), which is a survey of educational achievement organised by the Organisation for Economic Co-operation and Development (OECD) (Wheate, Wheeler, Burge, & Sizmur, 2012).
- The uptake of physical sciences at GCE A-level is declining at a time when the other UK regions are responding to the recommendations of the Sainsbury Review for an increase (Sainsbury, 2007) (Department for Employment and Learning and the Department of Education, 2009). There has also been a significant change over the past decade in the way in which pupils are combining STEM subjects at GCSE and A-level, reflecting a cultural bias towards professions such as medicine and professions allied to medicine. (The National Foundation for Educational Research, 2012), (Northern Ireland Assembly, 2012)).
- Continuous professional development for teachers and post primary levels has also been identified as an area that needs to be addressed with little resources currently being expended on it.

Case Study: Step Up

Step-Up is a unique and innovative interventionist programme that provides new learning opportunities for talented young people who live in areas of social and economic disadvantage. The programme aims to raise pupil's aspirations, expectations and academic performance, thereby enabling them to progress to Higher Education.

Aims

The programme specifically aims to:

- Raise pupil's performance in Science subjects.
- Encourage participation in Higher Education of young people who otherwise would not have regarded this as an option.
- Develop subject specific and general transferable study skills to facilitate the transition from school to Higher Education.
- Provide students with ongoing support to ensure successful completion of degree level programmes.

“ After completing university and embarking on my career in research and development, I can honestly say that Step Up was the right decision for me. I have thoroughly enjoyed my time spent at University which went hand in hand with a great deal of hard work and effort, something that the Step Up programme had prepared me for well”.

Dr. Catherine Pollock, Cancer Researcher, Step Up Graduate, Class of 2005



3.2 Technology

The vision of E-skills UK 4-year Strategic Plan for Northern Ireland's is that we are recognised as an international leader in delivering business value from technology. A vibrant technology workforce is critical for the success of every sector, and a world-class technology skills base is an essential pre-requisite for success in the global economy (e-skills UK, 2012). The report outlines the following issues: -

- 38% of employers surveyed who were seeking to recruit Information Technology (IT) specialists had experienced difficulties filling these positions and of the 48% of employers expecting to recruit IT specialists over the next 6 months, more than a quarter anticipated further difficulties.
- The number of people taking an IT related A-level decreased by 3% during the past year. However, while the numbers taking IT related GCSEs across the UK have declined by 72% between 2005 and 2011, numbers in Northern Ireland have grown by more than a quarter (27%) (e-skills UK, 2012).
- Whilst there is encouraging uptake in the numbers of young people studying technology at school and university in Northern Ireland, there is a stark gender imbalance (a much greater proportion of males), which means the sector is missing out on a large proportion of the talent pool.
- Graduates of technology related degrees are an important source of recruits for the sector with 62% of companies in Northern Ireland planning to source new recruits from here. Northern Ireland needs more than 1,900 new information technology professionals a year, filling increasingly complex, high value-added roles. Concern has, however, been raised about the teaching and learning in technology in schools at primary and post primary levels.
- Career advice was also flagged as an issue with careers advisers having limited understanding of IT-related careers and with young people still continuing to hold negative perceptions of the industry, as well as having a lack of understanding of information technology roles.

An 'Information and Communication Action Plan' from the Department for Employment and Learning (Department for Employment and Learning, 2012) additionally highlighted some areas for concern. For example: -

- Skills shortages are prevalent within the software development, infrastructure management and applications management sub sectors.
- There is evidence of a high number of suitably qualified individuals choosing other occupations.
- There are concerns about the provision of Computer Science in secondary level schools.
- A major issue is apparent at primary level where, like Science, IT is not on the curriculum at primary level. Young people are only required to be taught IT for 3 years (from Year 8 to Year 10).
- Continuous professional development is also an area of concern. For example, an A-Level in Software Development has recently been made available through the Council for Curriculum, Examinations and Assessment (CCEA). The A-Level is currently being piloted in a small number of schools in NI and there is, as yet, no GCSE in place. However, it is expected that the A-level will be available in Derry~Londonderry in 2015. A key issue will be ensuring that teachers are appropriately supported and qualified to deliver this A-Level. This is currently being addressed by the Ulster University at its Magee campus.

Within the ICT sector data analytics is an area with huge potential for growth. However, it is estimated that currently only 1% of data captured is analysed, despite more and more data being captured through the internet and online activity. If big data is the new oil that will fuel our economy in the coming decades then data analytics provides the tools to refine that oil and release the powerful insights held within. The demand for data analysts currently outstrips the supply and it is forecast that this demand will increase by 160 per cent between 2013 and 2020, adding 364,000 big data jobs to the UK economy. Not having the right people in place could be a huge barrier to our competitive advantage.

Building analytical capabilities is vital if the UK is to remain competitive in the global information economy. In its recent report on big data analytics the Tech Partnership notes that the arrival of the internet, where billions of internet connected devices will each generate their own stream of data, only serves to reinforce this. According to Cisco there will be 50 billion internet connected devices but the data is of no value unless there is the analytical capability to extract insights and business value from it.

3.3 Engineering

Traditionally, engineering and manufacturing play a pivotal role in determining and improving a region's economic performance and its competitiveness. Over the last decade, the Northern Ireland manufacturing/engineering sector has experienced significant change, the result of technological changes and the pressures from competing businesses around the world. As a result many sectors are predicting significant growth over the coming years, which will create a rise in the demand for skilled labour in engineering. According to a recent report commissioned by the Department of Education it has been proposed that aerospace, agri-food and sustainable energy (RSM McClure Watters (Consulting), 2013) are expected to grow substantially over the next few years.

The report highlights one major challenge to the engineering sector is its image problem. Generally, it is not seen as being as desirable a career choice as professions such as law, medicine and accountancy, which are perceived as offering better financial rewards. Another key challenge is the gender imbalance in engineering which is markedly worse in NI than the UK average (Department for Employment and Learning , 2012).

¹Big Data Analytics – Assessment of Demand for Labour and Skills 2013 – 2020 (Tech Partnership Oct 2014)

Case Study: CultureTECH

CultureTECH

Taking place annually in Derry-Londonderry, CultureTECH is Northern Ireland's Innovation Festival, and the largest technology event in the region. The week-long festival incorporates over 200 individual events and sessions, delivered in partnership with a range of public and private sector stakeholders, and is supported by year-round programme of educational and industry outreach activities.

Key facts:

- Unique combination of technology, science and arts programming
- Over 43,000 attendees in 2014
- Supported by over 130 event partners and funders
- Major focus on STEM/STEAM subjects, reaching 16,000+ young people during the festival
- Outreach programme delivered in 150+ schools across Northern Ireland
- Targeting growth to 65,000 attendees in 2015

“A lot of young people getting a very clear message that science, technology and all things digital are cool, fascinating and exciting.”
Brian Burns, VP, Seagate



3.4 Mathematics

Mathematics is at the heart of the Northern Ireland curriculum. We have one of the best performing education systems for primary maths in Europe, and the sixth best in the world, according to a major United States study (Mullis, Martin, Foy, & Arora, 2011). Mathematics is fundamental to a career in STEM. For young people to become well-informed and active members of society, and to be able to contribute to the economy, they need to acquire appropriate mathematical knowledge, understanding and skills (Education and Training Inspectorate of Northern Ireland, 2013).

A 2012 Northern Ireland Audit Office (NIAO) report on literacy and numeracy performance in Northern Ireland schools found:

- At the end of primary school (year 7), more than one in six pupils has not achieved the expected standard in literacy (3,876 pupils) and numeracy (3,754 pupils).
- By Key Stage 3 (year 10), more than one in five pupils has not achieved the expected standard in literacy (5,000 pupils) and numeracy (5,500 pupils).
- By GCSE, two in five (9,000 pupils) leave full-time education without having achieved the required standard in literacy and numeracy.

There is a strong correlation between low levels of academic achievement and free school meal entitlement (an indicator of social deprivation). The report also highlights further disparities in pupil achievement according to gender, residency and religion. The report highlights the need for ongoing consideration to be given to ways of identifying and sharing practices that are already working to raise levels of literacy and numeracy achievement in schools (Northern Ireland Audit Office, 2013) .

Concerns have been raised about performance in post primary education. This is echoed by the Programme for International Student Assessment (PISA). In 2012 the report stated that 15-year-olds in Northern Ireland performed significantly below the OECD average in Mathematics. Indeed, 25 countries significantly outperformed Northern Ireland, including 12 EU countries. There is a need, therefore, to review whether or not current initiatives are adequately addressing the development of mathematical knowledge and the difficulties experienced by many young people in applying their mathematical skills at this level (Department for Employment and Learning and the Department of Education, 2009).



Case Study: Sentinus

Sentinus

The home of STEM outreach in Northern Ireland

Sentinus engages more than 60,000 young people each year in programmes designed to excite and enthuse them about Science, Technology, Engineering and Maths, support their development and enhance their life skills. These programmes can be used to support the delivery of a structured Careers Education programme in schools.

Industrial Research Placements

Sentinus offers almost 100 industrial placements to AS level students every year, lasting between four and six weeks. Recognised by universities and employers as a valuable addition to a personal statement, these placements offer students invaluable experience of the work place.

Careers Presentations

Sentinus provides 80 careers presentations in schools each year, bringing role models into the classroom to relate their own career experiences and influences to pupils in Year 10.

"I would like to express our thanks for the delivery of an excellent 'Experiences of Work' programme. All of our pupils enjoyed the information session and have certainly gained great knowledge about various careers and the world of work. I must say, I am looking forward to working again with Sentinus in the future to enrich the NICHS Careers programme."
- Teacher, Newtownabbey Community High School

Extended Projects

Sentinus runs an extensive range of extended projects which engage young people in problem solving project work, supported by scientists and engineers from industry. Lasting 4 - 10 weeks, these projects highlight the value and relevance of the STEM subjects and potential career opportunities in the sector.

STEM Roadshow Programmes

Sentinus delivers one-day STEM roadshows covering a wide range of subject areas including maths, science, technology engineering and computer programming. All of these can be used to emphasise the importance of science and technology, within a careers context.

"I enjoyed using the robots and the computer to program them. I also enjoyed watching the videos and learning about the Air Bus. It was a brilliant morning and my opinion has definitely changed on engineering. I never thought I would really enjoy STEM subjects and you have changed my options for a future career. Thank you very much."
- Pupil, St. Fanchea's College

"I think this is a superb opportunity for our young people, and I know it will help them enormously with their studies for A-level and their future careers."
- Teacher, St. Mary's College Derry

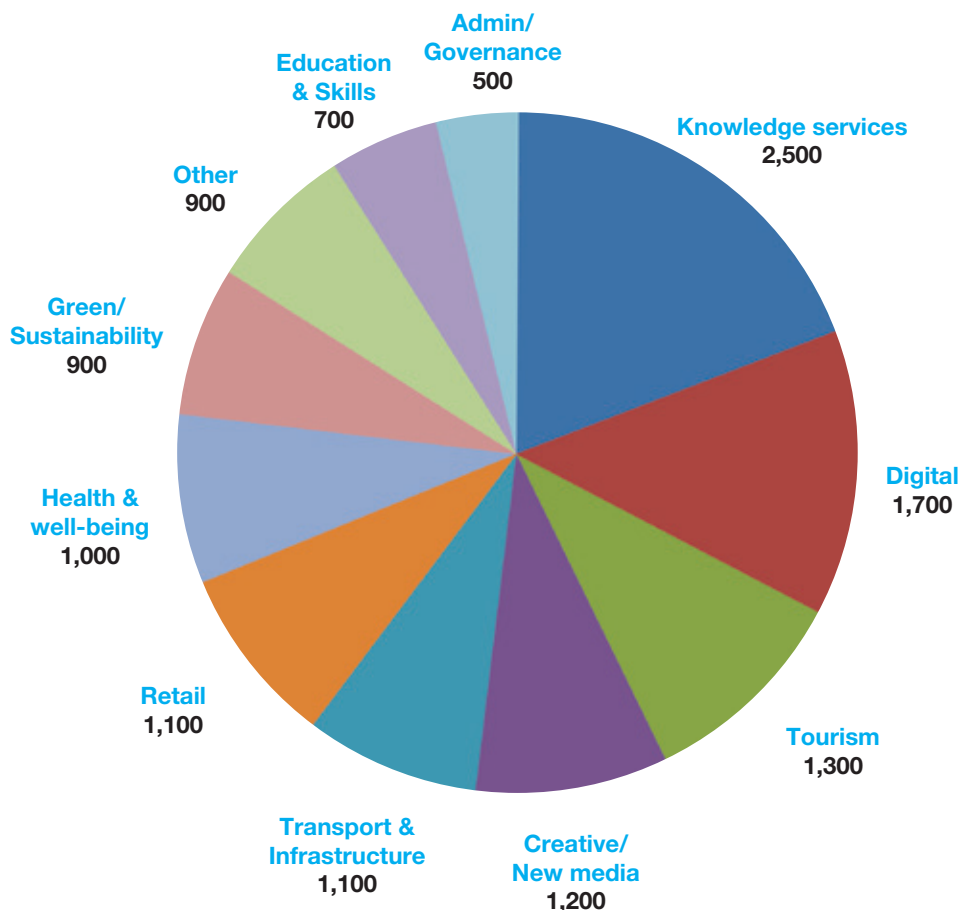


www.sentinus.co.uk
info@sentinus.co.uk
028 9262 7755



4.0 A focus on the North West

Focusing on the North West, the One Plan (Ilex, 2013) for Derry~Londonderry commits to growing the economy through the creation of 12,900 jobs across a range of sectors, many of which are underpinned by STEM knowledge and expertise, fig 1.



4.1 Key priorities

Increasing opportunities for young people to gain strong STEM skills is essential if Northern Ireland, and in particular the North West, is to continue its remarkable record of success in science and innovation.

The city has now in place many world-class physical and educational assets that promote research and development and play a key role in positioning STEM at the heart of our local and regional economy. The Ulster University at its Magee and Coleraine campuses has developed world leading research centres, including the Intelligent Systems Research Centre (ISRC), the Biomedical Science Research Institute (BMSRI) and the Clinical Translational Research Centre (C-TRIC). The Magee campus is also home to the Bamford Centre, which specialises in mental health research. The Centre for Stratified/Personalised Medicine, which links the C-TRIC centre based at Altnagelvin with the BMSRI centre at Coleraine, will create over 60 high level research posts.. The recently opened North West Regional Science Park (NWRSP) creates an ideal environment to promote the commercialisation of research from all these centres, leading to the creation of over 250 high value jobs in the city and new STEM businesses. In addition, the development of the Creative Hub at Ebrington aims to focus on growing digital and creative technology businesses in the city with over 50 jobs projected. Investing in the future of STEM makes sense for international and local STEM related businesses in Derry~Londonderry.

Case Study: Nerve Centre Creative Learning Centre and FabLab



Creative Learning Centres (CLCs) were established ten years ago to embed creative digital technologies within schools in Northern Ireland and to provide the skills and resources for teachers and learners to use them as core learning tools. The Nerve Centre is one of three CLCs in Northern Ireland (alongside Nerve Belfast and Armagh's AMMA Centre). The Nerve Centre CLC has played a leading role in building inclusion and engagement in STEM based learning through the STEM > STEAM movement which uses the Arts and Creativity to make learning about STEM more interesting, more relevant and more fun.

Working directly with partners including the CCEA, Rhode Island School of Design and MIT, the CLCs have developed bespoke programmes for teachers and learners which embed STEM skills across the curriculum, using creativity as the means for all teachers to engage with STEM in meaningful ways across all subject areas. This may mean learners using 3D design and printing to recreate historic monuments, or coding a computer game to learn Mathematics. A key focus of this work is in delivering the digital and STEM skills required in the modern workplace for teachers and learners to use in the modern classroom and encouraging hands on creative learning – ensuring that students are active participants in learning, rather than passive recipients of learning.

The Nerve Centre is also home to Ireland's first FabLab - a concept developed by the Centre for Bits and Atoms MIT which brings digital disruption to education, manufacturing, employment and learning. Using tools including laser cutters, 3D printers, CNC cutters and computer controllers such as Arduino and Raspberry Pi, users are given the skills to design and build products and solutions from a basic key ring right up to solar powered house.



FabLabs fuse creative problem solving with digital technology and hands on making to deliver a powerful learning tool across school, community and business. FabLab Nerve Centre, delivered in Partnership with FabLab Belfast at the Ashton Centre, has pioneered the development of accredited jobskills programmes for NEETS; curriculum linked schools programmes at Key Stages 2,3 and 4 mapped and delivered in subjects ranging from Maths and Physics to History and Citizenship; Mental Health Programmes and a range of artistic and entrepreneurial projects. The CLCs also lead the FutureClassrooms.org project, which showcases STEAM based work in Northern Ireland and internationally, with an annual conference held in Derry~Londonderry in 2014.

www.nervecentre.org | www.futureclassrooms.org

5.0 Priority Areas

Through the work of the city's Education and Skills Implementation Group and its various working groups and discussions with key stakeholders including Ulster University, North West Regional College, Chamber of Commerce, Derry City Council, schools, Sentinus and W5 the North West STEM Action Plan has identified a number of priority areas going forward, presented in fig 3.

- Enhanced and coordinated schools and community engagement activity promoting career attractiveness at primary and post primary level and also with parents.
- Development of enhanced STEM delivery and engagement within further education including clearly identified progression routes.
- Enhanced STEM at undergraduate and post graduate level to meet the needs of STEM employers in the region.
- Enhanced employer engagement will be a key feature of all activity undertaken with schools, community, further and higher levels.

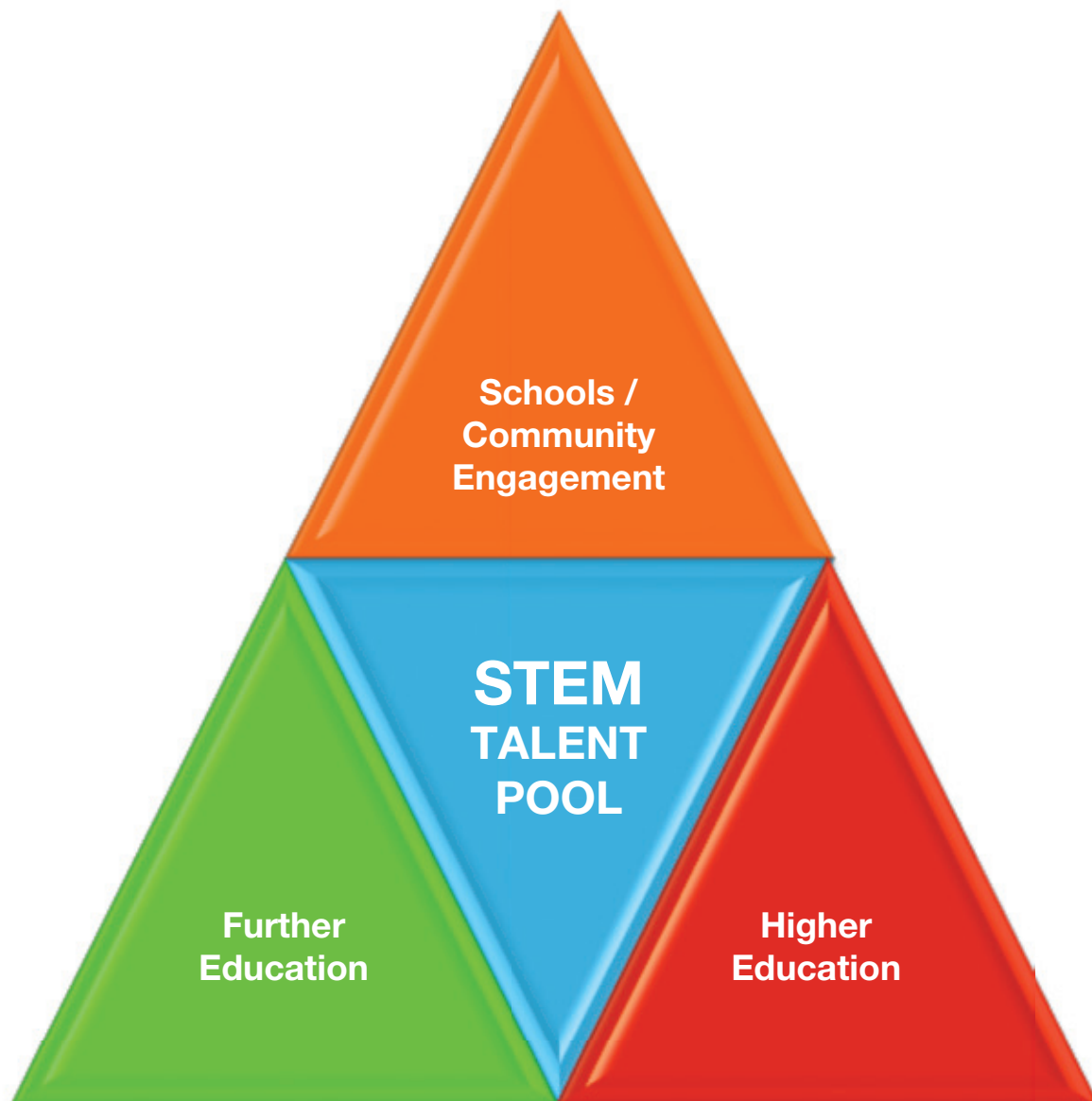


Fig 3: STEM Talent Pool

6.0 Conclusion and moving forward

If we are to grow our economy and help businesses maintain their competitive edge we must motivate students of all abilities into STEM fields. The reports highlighted in this North West STEM Action Plan have already had an impact and it is important to note that recent statistical evidence shows that the STEM decline is starting to reverse. In 2012/13, 46% of Northern Ireland domiciled students at UK higher education institutions were studying a broad STEM related subject and 23% a narrow STEM related subject (Department for Employment and Learning, 2013).

To accentuate this trend, we must support and guide our students, schools, teachers and businesses. Because STEM is so important for our children, city and region we need to encourage the students currently in our educational systems, as well as future generations, to understand and embrace the technology that affects them every day of their lives. In moving forward we need to:

- Ensure that science is promoted as a regional priority;
- Coach and guide students on the merits of mathematics;
- Address the gender issue and uptake of engineering and technology;
- Develop Continuous Professional Development courses to create engaged and enthusiastic teachers who use hands on and minds on activities;
- Create graduates who meet the needs of industry;
- Promote STEM as an exciting and rewarding career;
- Ensure parents are knowledgeable about the possibilities within STEM.

In conclusion, two resources are associated with this North West STEM Action Plan. Firstly, three priority areas are identified which include: -

1. Schools and Community Engagement
2. Further Education
3. Higher Education

Each priority lists a number of actions which include programmes, initiatives and campaigns. Each action has associated outcomes, partners and timescales.

Secondly, the North West Action Plan has developed a comprehensive calendar of events which aims to provide information on key local and national STEM related events. A summary of the events, the location and the dates and associated web links are provided for each event.



7.0 Action Plan

The action plan, which is detailed below, sets out the priority actions required under each of the above themes. It is not designed to be a static document but will grow and develop over time. It will be reviewed and updated on an annual basis. In addition, formal monitoring and evaluation procedures will be in place to ensure the outcomes are effectively measured.

Case Study:



The Seagate Real World Science Conference

The Seagate Real World Science Conference is an annual one-day STEM event targeting year 10 pupils. It was developed in 2007 by a small team of Seagate volunteers, with support from two local post-primary science teachers.

The main objective of the conference is to give participating students the opportunity to sample a variety of STEM careers through interactive, hands-on workshops. A total of 18 to 20 workshops are on offer each year, with students getting the opportunity to attend three, which they register for in advance of the event. In addition to three Seagate workshops focused on actual processes used daily in the Springtown facility, a number of other STEM employers support the event by providing workshops (e.g. PSNI, NI Fire and Rescue Service, Invista, Loughs Agency, Forest Service, NI Ambulance Service, NIE, Greencastle Planetarium). Additional workshops are also provided by University of Ulster, Queen's University Belfast and a number of other STEM promotion organisations such as Sentinus and STEM Aware.

The conference has become well established on the academic calendar and is attended each year by some 300 pupils from a number of schools in the North West. Post-primary schools in Londonderry, Strabane, Limavady, Claudy, Dungiven and Bunrana are invited to the event, most of which attend each year.



8.0 Priority Areas

The action plan, which is detailed below, sets out the priority actions required under each of the above themes. It is not designed to be a static document but will grow and develop over time. It will be reviewed and updated on an annual basis. In addition, formal monitoring and evaluation procedures will be in place to ensure the outcomes are effectively measured.

Priority Area 1: Schools, Parents and Community Engagement

Action	Outcome	Partners	Timescales
STEM mentorship programme	Bank of STEM mentors created to work with schools and community groups to increase STEM awareness and understanding	All	January 2015
Develop and extend the reach of the successful FabLab model.	Increased awareness amongst young people of STEM/STEAM	Nerve Centre/FabLab, DCAL	Ongoing
Increase the levels of coding and programming activities in primary and post primary schools and in the community.	Delivery of a range of initiatives and programmes e.g. extend Coder Dojo, CultureTECH Junior, Go Beserk, Bring IT On, City Wide Digital Literacy programme.	Sentinus, Coder Dojo, STEM Aware, CultureTECH, E-Skills, primary/ post primary Schools, Align IT, NWRC, Nerve Centre, Coder Dojo.	Ongoing
Increase the level of parental engagement in STEM careers awareness activities and STEM activities.	Increased awareness amongst parents regarding importance of STEM and potential STEM careers.	SEC, Primary and Post Primary Sector, UU, NWRC, CultureTECH, Nerve Centre.	Commencing January 2015
Widening participation programmes focusing on Mathematics at primary and post primary levels.	Step Up to Mathematics developed. Improved levels of numeracy	UU, primary and post primary sector	September 2015
Widening participation programmes focusing on IT and digital literacy skills.	Step Up to IT Improved levels of digital literacy across primary and post primary levels.	UU, primary and post primary sector	April 2015
Widening participation programmes focusing on engineering.	Step Up to Engineering. Improved awareness of engineering careers across post primary levels. Increased uptake of engineering studies at FE and HE.	UU, Sentinus primary and post primary sector.	April 2015

Action	Outcome	Partners	Timescales
Development of a city wide digital literacy programme targeted at Year 8 to Year 10.	<p>Proposal developed for a digital literacy programme for post primary sector.</p> <p>Increased awareness of ICT, coding, programming and app development;</p> <p>Creation of pipeline to GCSE and A-level;</p> <p>Increased awareness of career opportunities in STEM related industries.</p>	UU, Ilex, Foyle Learning Community, private sector, NWRC, Nerve Centre	April 2015
Develop and enhance the NWRSP activities schools engagement activity in the NW.	<p>Increase in number of schools participating in NW.</p> <p>Increased awareness of STEM opportunities and careers.</p>	NWRSP, CultureTECH, Sentinus, post primary sector (FLC).	Ongoing
Extend the Bring IT On campaign in the NW.	<p>All primary and post primary schools accessing Bring It On.</p> <p>Bring it On extended to community.</p>	E-Skills, DEL, Sentinus, post primary sector, NWRC.	Ongoing
Delivery of A-Level in Software Development in post primary.	<p>Demand stimulated for the delivery of new A-Level in NW with young people in post primary sector e.g. digital map.</p> <p>Parental engagement to promote career attractiveness of IT sector.</p> <p>A Level available within post-primary sector by Sept 2015.</p>	Foyle Learning Community, post primary sector.	September 2015
CPD for Teachers	<p>Pilot CPD module for A Level Software Development.</p> <p>Pilot CPD module for engineering teachers in 2014.</p> <p>Replicate CPD model across other subject areas.</p>	Education and Skills Implementation Group, UU, FLC, Nerve Centre.	October 2015
Enhanced Careers Advice focusing on STEM careers including parental engagement, career attractiveness and improved industry information for teachers and advisors.	<p>Digital/IT Map for City.</p> <p>Engineering map for City.</p> <p>App development for STEM careers.</p> <p>Increase in numbers of teachers on work placement in industry.</p> <p>STEM Careers DVD/On Line resource.</p> <p>Engagement in DEL/DE review of careers strategy.</p>	Ilex, ESIG, private sector, post primary sector, NWRC, UU, Nerve Centre	October 2015

Action	Outcome	Partners	Timescales
Development of a STEM Hall of Fame for the city.	Schools competition launched January 2015. Hall of Fame launched in Year of Science 2015. Role Models to inspire young people.	Post primary sector, CultureTECH.	January 2015
Creation of a bank of STEM animateurs to work with primary and post primary sectors and community/voluntary sector.	Ongoing engagement activity with schools particularly through events and STEM awareness activities. Increased awareness and profile of importance of STEM.	UU, NWRC, CultureTECH, Nerve Centre.	Ongoing
Calendar of events for STEM Activity including a focus on key events such as CultureTECH, SciFest, FabLab, Maths Week, Science and Engineering week and encouraging greater co-ordination between schools.	Increased collaboration between schools and employers in relation to delivery of key STEM event. Calendar of events developed and agreed amongst key stakeholders. Programme developed for City of Science 2015	All stakeholders.	Ongoing
E-Bulletin highlighting key resources available to support STEM activities.	Quarterly bulletin circulated to schools, employers and STEM activity providers, highlighting resources and events and funding opportunities.	Ilex, DCSD, all stakeholders.	Ongoing
Development of STEM careers portal linked to education and work experience opportunities similar to www.careersportal.ie.	Improved careers advice and guidance for young people. Access to detailed information on STEM careers for parents, careers teachers and careers advisors.	ESIG, Ilex, DEL, DE, Post primary sector, WELB, Align IT. DCSDC.	Ongoing
Development of a funding toolkit for primary and post primary schools.	Increased awareness of external funding sources for primary and post primary schools Increased STEM activities within primary and post primary sector due to leverage of additional funding and sponsorship opportunities.	Ilex, school sector.	October 2015
Appointment of a STEM Laureate – inaugural year to coincide with Year of Science 2015.	Raise profile and awareness of numeracy development in the City.	DCSDC (LEGACY)	January 2015
Development of a work experience model that exposes young people to STEM careers	Young people have a greater understanding of the nature of work in STEM sectors. STEM supplements – parents, schools, business. Increase parental awareness of STEM courses and careers.	SEC, private sector, Chamber, Sentinus.	Ongoing

Priority Areas

Priority Area 2: Further Education

Action	Outcome	Partners	Timescales
Development of employer led apprenticeships across a range of STEM sectors.	<p>Pilot apprenticeship programme for IT sector.</p> <p>Pilot employer led apprenticeship for engineering sector.</p> <p>12 apprentices employed in local companies.</p>	Private sector, NWRC and DEL.	September 2015
Increase in levels of coding and programming amongst non-IT students in further education and in community.	<p>NWRC delivering a number of digital literacy courses to non-IT students.</p> <p>Embed digital literacy as a core element of courses.</p>	NWRC, Nerve Centre.	Ongoing
Development of a STEM bursary scheme for FE students.	Maximise uptake of STEM bursaries in NW.	NWRC, private sector.	January 2016
Continued delivery of Software Developers Programme for non IT graduates.	<p>Increased competencies amongst graduates to fill roles within the IT and digital sector.</p> <p>Retention of graduates and FE students.</p>	NWRC, DEL.	Ongoing
Development of Academy model in STEM related areas.	<p>Needs of businesses in relation to skills deficits addressed.</p> <p>Development of higher level skills to meet needs of industry.</p> <p>Vacancies filled.</p>	NWRC, DEL.	Ongoing
Development and delivery of higher level apprentices.	Explore the demand and need for higher level apprentices through engagement with businesses through digital and engineering working groups.	NWRC, DEL	September 2015
Increase FE provision in STEM related subjects.	<p>Increase current provision by 2015.</p> <p>Achieve targets as set out in One Plan for higher education provision.</p>	NWRC, Nerve Centre.	Ongoing
Development of STEM Centre.	<p>Shared education facility focusing on STEM.</p> <p>Linkages between FE, post primary and primary education.</p> <p>Focal point in the city for the delivery of STEM education.</p> <p>Exhibition space to inspire and engage young people in STEM subjects.</p>	NWRC, FLC, UU, Nerve Centre.	Ongoing

Action	Outcome	Partners	Timescales
Development of a work experience model for further education students in STEM related areas.	Improved employability skills amongst FE students. Access to valuable experience for young people.	NWRC, SEC, Sentinus, private sector.	September 2015
Development of a Maths Access Centre at NWRC.	Improved levels of numeracy amongst FE students. Increased community access. CPD for teachers developed and delivered. Higher levels of attainment. Improved pathways to STEM related subjects.	NWRC, community/voluntary sector.	September 2015
Increase support for SMEs through continued delivery of programmes such as Employers Support Programme, Business Improvement Techniques, Customised Training and Innovation Vouchers.	Increased uptake of innovation vouchers and support programmes. Knowledge transfer between academia and industry.	NWRC, private sector, DEL.	Ongoing
Work collaboratively with UU and business developing innovation. Increase international dimension through participation in European projects e.g. Erasmus – best practice visits.	Knowledge transfer opportunities enhanced and increased.	NWRC, UU, private sector.	Ongoing
Work placements for lecturers into STEM related industries.	Greater exposure to new skills and techniques in industry. Transfer of skills and knowledge within NWRC and to students.	NWRC, private sector.	Ongoing

Priority Areas

Priority Area 3: Higher Education

Action	Outcome	Partners	Timescales
Maximise uptake of STEM bursaries.	Promote availability of STEM bursaries across post primary and FE sector Increase uptake in NW	Private sector, DEL.	Ongoing
Progression routes from FE to HE particularly in STEM areas clearly articulated.	Young people able to complete degree level study from foundation degree locally; Increase in number of young people progressing from NWRC to UU Magee in economically relevant areas of study.	UU, NWRC.	September 2015
Increase of MaSN in STEM related areas.	Higher Education Expansion Working Group. Stimulate demand across private sector and education.	UU, DEL.	Ongoing
Increase number of STEM graduates from NW.	Expansion of university in STEM related areas e.g. new School of Engineering at Magee.	UU.	Ongoing
Diaspora programme – attract back campaign.	Programme developed to attract back STEM graduates to the region to address recruitment needs of local employers.	UU, DCSDC, Chamber of Commerce.	January 2016
Build on the university's centres of excellence to attract new investment and inspire young people to consider STEM related careers.	Increase in numbers of young people studying STEM related careers.	UU, private sector.	Ongoing
Development of a Centre of Excellence for Advanced Manufacturing and Engineering.	Enhance the research and innovation capacity of the region. Create a pipeline of young people equipped with the skills, knowledge and expertise for careers in the engineering sector. Increased uptake in innovation vouchers, and innovation schemes. Attract new investment in the sector.	UU, NWRC, Nerve Centre.	Ongoing

Priority Areas

Priority Area 4: Showcasing Local Innovation

Action	Outcome	Partners	Timescales
Development of a series of case studies of local entrepreneurs and innovators to promote career attractiveness and local champions.	Young people equipped with skills and knowledge to make informed choices. Increased awareness of STEM careers within local businesses.	Private sector, Chamber of Commerce, DCSDC.	September 2015
Develop a bank of young role models from industry to promote STEM careers.	Increased awareness of STEM careers and study opportunities.	CultureTECH, NWR-SP, private sector, UU, NWRC, Nerve Centre/ FabLab.	September 2015
Showcase the research and innovation capacity of the region e.g. Bubble Bum, E&I Engineering, Invista etc.	Increased awareness of the research and innovation capacity of the region.	Chamber of Commerce, UU, NWRSP.	Ongoing
Ensure there is a NW focus to the work of Align IT and increased awareness of the IT/digital sector regionally.	NW events with schools and private sector to promote IT industry. Increased awareness of the career options available within STEM industries.	Align IT, schools, NWRC, LYIT, UU, Sentinus.	Ongoing
Work with the Collaborative Network for the Advanced Manufacturing and Engineering sector to promote STEM careers and identify local skills shortages and barriers to growth.	Increased awareness of the career options available within STEM industries. Increased engagement between industry and education.	SEC, private sector, schools, NWRC, UU, Sentinus.	Ongoing
Pilot a series of parent evenings with local STEM industries.	Increased awareness of the career options available within STEM industries. More young people studying STEM subjects and pursuing STEM careers.	Schools, employers, parents, young people	September 2015
Development of a centre of excellence for Advanced Manufacturing and Engineering.	Enhance the research and innovation capacity of the region. Create a pipeline of young people equipped with the skills, knowledge and expertise for careers in the engineering sector. Increased uptake in innovation vouchers, and innovation schemes. Attract new investment in the sector.	UU, NWRC, Nerve Centre.	Ongoing

Appendix A: STEM Reports commissioned by the Department for Employment and Learning (DEL) and the Department Of Education (DE).

1. Report of the STEM Summary (2009)

The 'Report of the STEM Review' noted that like many other developed countries, our young people are increasingly disengaged from STEM, which has manifested itself in reducing enrolments in courses in those STEM subject areas which will be critical to our future economic growth. This phenomenon has been defined as STEM fatigue and it is evident from the early primary school years right through post primary school, further education and university. The natural consequence is a reducing flow of those who are qualified in STEM subjects at all levels into the workforce. The report outlines the key actions moving forward, which include:

1.1 Uptake of STEM subjects and continued professional development issues

The review sought to identify the constraints and losses at each stage in the STEM artery. In addition to the general decline in the uptake of STEM subjects, it noted that there are a number of factors which are unique to Northern Ireland. For example, there is little planning at the primary/post primary school interface in STEM which impinges upon pupils' progression at Key Stage 3. Furthermore, the relevant Continuous Professional Development undertaken by teachers and lecturers appears to be very limited. From a careers perspective, insufficient time is allocated to planning for providing careers guidance in the majority of schools. It notes that while the uptake of STEM subjects within further education has increased overall, there is an ongoing decline in certain STEM subjects which are important for economic growth. There are concerns about the success rate in certain subject areas within further education, while the gender imbalance in engineering is markedly worse than the UK average.

1.2 STEM attractiveness in education and career choices

The review stresses that we must find ways to attract our young people into STEM education and ultimately into STEM careers. There is a real need to provide a STEM education which fulfils three main functions if it is to equip young people to be active members of society.

- All pupils need to be equipped with the knowledge, skills and aptitudes required to engage purposefully with science related issues they will encounter as individuals and as citizens in a society increasingly shaped by scientific and technological advance – STEM literacy;
- Many pupils need to gain the further and higher education STEM qualifications and the work class skills in an increasingly STEM based business environment;
- A significant number of young people need to gain the education and world-class skills required to invent and create STEM businesses here, and to help grow a dynamic and innovative economy.



1.3 Cultural bias and student retention issues

There has also been a significant change in the past decade in the way in which young people combine STEM subjects at A-Level and this appears to reflect a cultural bias towards professions such as medicine. The uptake of physical sciences at A-Level is declining. The review also observed that between 10% and 18% of STEM students at universities in Northern Ireland drop out at the end of the first year and migration loss remains a major issue with around 26% of Northern Ireland domiciled students who graduate in STEM courses in the United Kingdom each year choosing not to live and work here following graduation.

1.4 Parental perceptions

Parents' perceptions of the private sector are frequently limited which quickly becomes apparent when discussing their children's choice of subjects and career aspirations. Parents therefore need to understand the role of STEM in our economy and the many rewarding careers available to their children.

2.0 Success through STEM summary (2011)

The Success through Stem Report was commissioned in a response to the 'Report of the STEM Review'. The 2011 report focuses on the formation of a steering group responsible for taking forward the recommendations outlined in section which include:

2.1 Existing government STEM activity

Activity relating to STEM is highlighted by Department and the Government STEM action plan is outlined. The report outlines the key actions moving forward.

2.2 The role of the demand side

Employers have the key role to play in improving the attractiveness of the STEM sector and in highlighting the opportunities that exist locally and in working with the supply side to encourage demand and ensure that the courses that are in place meet their needs.

2.3 The role of the supply side

It is government's objective to ensure that the young people leaving compulsory education have the skills and qualifications that will enable them to gain meaningful employment and that those people who have left education and wish to improve their skills have access to appropriate up-skilling and re-skilling programmes.



2.4 Priority Action

The report concludes by highlighting three areas identified as priorities for the Executive to take forward in the short term;

- Priority Action 1 - Co-ordinate Business Links
- Priority Action 2 – Manage STEM Sector Attractiveness
- Priority Action 3 – Facilitate STEM Continuous Professional Development

2.5 Structure for implementation

As with any strategy, it is important to create appropriate delivery structures to ensure successful implementation. A STEM delivery infrastructure outlined in fig 1 proposed the delivery infrastructure moving forward.

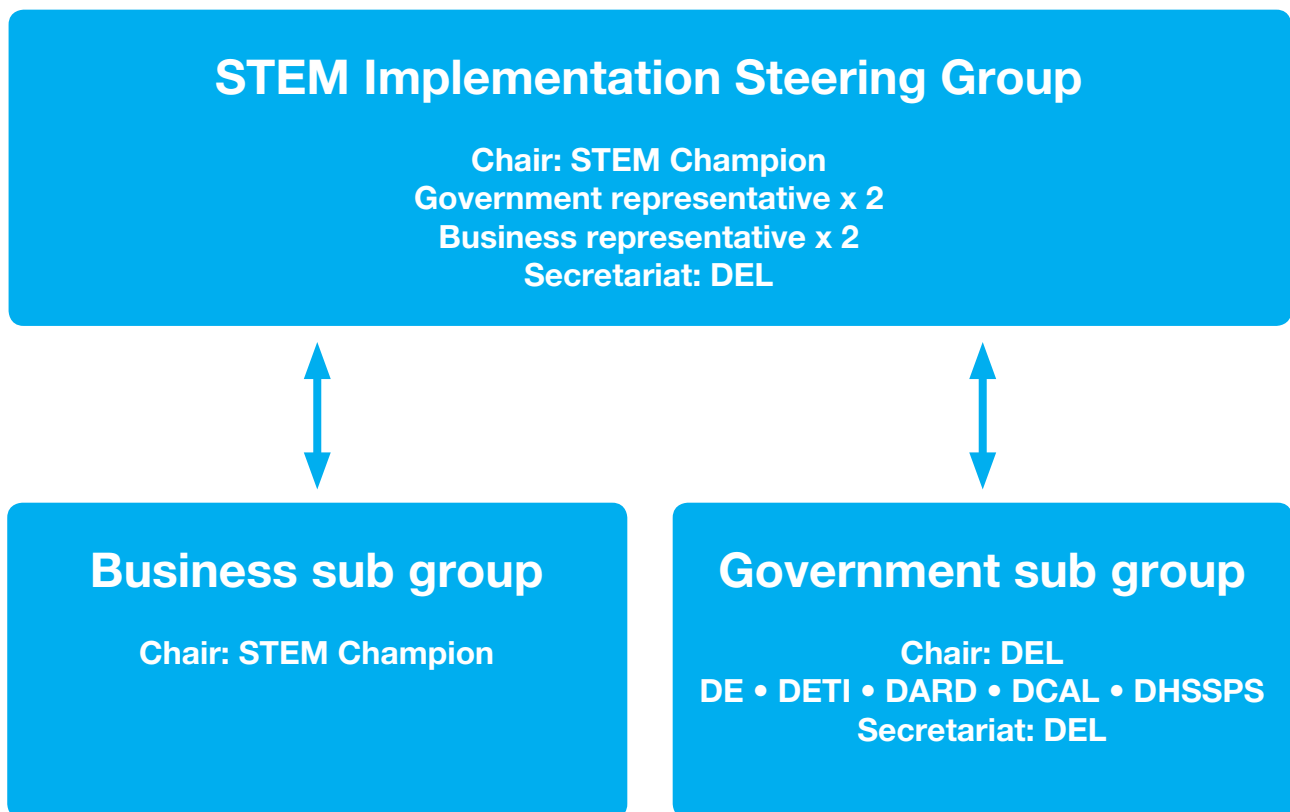


Figure 1: STEM Implementation Steering Group (Department for Employment and Learning and the Department of Education, 2011).

3.0 Success through STEM - One Year On Summary (2012)

Success through STEM - One Year On aims to highlight the successful collaboration between government and business in raising the profile of STEM skills and careers and identifies the progress that has been made since the publication of the STEM Strategy. The report focuses, and this section concludes, on the delivery structures of three key priorities actions.

3.1 Priority ACTION 1 – Co-ordinate Business Links

As noted in the STEM Strategy, better linkages with local companies, particularly SMEs and micro businesses, will facilitate a more coordinated approach to articulating local demand, improving sector attractiveness, highlighting available opportunities, Continuous Professional Development and careers advice and guidance. Engaging with these companies is the single biggest challenge in taking the STEM strategy forward. Key actions include:

- The STEM Business sub group meeting with key stakeholders in STEM focused workshops to promote, co-ordinate and share STEM related activities.
- STEM Business sub group establishing a database of local STEM companies and their engagement with local schools, universities and colleges.
- STEM Business sub group holding meetings with employer bodies to help communicate key messages to local STEM businesses.

3.2 Priority ACTION 2 – Manage STEM Sector Attractiveness

There is a clear need to find ways to engage with parents and young people to highlight the opportunities that are available in STEM throughout Northern Ireland. At present there are a number of organisations taking forward STEM sector attractiveness. A key element of the strategy is the need to link these organisations together. Key actions include;

- The STEM Business Sub-group (SBSG) has identified the Council for Curriculum, Examinations and Assessment's (CCEA) 'STEMWorks' website <http://www.nicurriculum.org.uk/STEMworks/> as the main STEM portal.
- The SBSG has been working closely with the Department of Enterprise, Trade and Investment (DETI) (via MATRIX, The Northern Ireland Science Industry Panel), CCEA and C2K (the schools ICT facility) to deliver the exciting STEM Innovation Video Conferencing programme to schools.
- The North/South Education Underachievement Working Group remains focused on work to tackle underachievement in literacy and numeracy.

3.3 Priority ACTION 2 – Manage STEM Sector Attractiveness

Priority ACTION 3 – Facilitate STEM Continuous Professional Development

Continuous professional development is essential to help teachers and lecturers in schools, colleges and universities to better contextualise their subjects. It also can have a significant influence on initial careers thinking of students. Key actions include:

- Department of Education providing additional STEM funding to the five Education and Library Boards (ELBs) to enable them to deliver STEM projects/ initiatives.
- As part of the ELB STEM Careers Education, Advice, Information and Guidance (CEAIG) project, group members provide ongoing support to teachers in the Area Learning Communities to identify and share good practice both within their own school and with other schools.
- ELB STEM CEIAG Group launched <http://www.go4stemni.org.uk/>, a website for teachers to share good practice which contains learning and teaching resources. The site provides ideas on how teachers can raise awareness of STEM careers and provides easy access to a range of publications and links to a wide variety of STEM and CEIAG organisations and resources.

The STEM situation is further reflected by additional reports echoing the issues raised in the Department for Employment and Learning and the Department of Education STEM reports.



Bibliography

Committee on STEM Education. (2013). **FEDERAL SCIENCE, TECHNOLOGY**. Executive Office of the President of the United States of America.

Department for Education. (2011). **The STEM cohesion programme: final report**. Department for Education.

Department for Employment and Learning. (2009). **Forecasting Future Skill Needs in Northern Ireland**. Lisburn: Oxford Economics in association with FGS Consulting.

Department for Employment and Learning. (2012). **Analysis of the Engineering Sector in Northern Ireland**. Belfast: Department for Employment and Learning.

Department for Employment and Learning. (2006). **Success through Skills: The Skills Strategy for Northern Ireland**. Belfast: Department for Employment and Learning.

Department for Employment and Learning. (2012). **ICT Action Plan**. Belfast: Department for Employment and Learning.

Department for Employment and Learning. (2013). **Enrolments at UK Higher Education Institutions: Northern Ireland analysis 2012/13**. Belfast: Department for Employment and Learning.

Department for Employment and Learning and the Department of Education. (2009). **Report of the STEM Review**. Belfast: Department for Employment and Learning and the Department of Education.

Department for Employment and Learning and the Department of Education. (2011). **Success through STEM: In response to the 'Report of the STEM Review'**. Belfast: Department for Employment and Learning and the Department of Education.

Department for Employment and Learning and the Department of Education. (2012). **Success through STEM: One Year On**. Belfast: Department for Employment and Learning and the Department of Education.

E&I Engineering. (2014). **E&I Engineering**. (E&I Engineering) Retrieved March 2, 2014, from <http://www.e-i-eng.com/>

Education and Training Inspectorate of Northern Ireland. (2013). **Survey of best practice in English and mathematics in post-primary schools**. Belfast: Education and Training Inspectorate of Northern Ireland.

e-skills UK. (2012). **Strategic Plan for Northern Ireland**. London: e-skills UK.

Go Berserk. (2014, March 24). **Go Berserk training in Derry-Londonderry**. (Go Berserk) Retrieved March 24, 2014, from <http://www.go-berserk.com/news.php#GoBerserkTrainingDerry>

Higher Education Funding Council for England. (2014). **Higher education in England 2014**.

Ilex. (2013). **One City One Plan One Voice**. Derry-Londonderry: Ilex.

MATRIX. (2008). **First Report of MATRIX: The Northern Ireland Science Industry Panel**. Belfast: MATRIX.

Mullis, I. V., Martin, M. O., Foy, P., & Arora, A. (2011). **TIMSS 2011 International Results in Mathematics**. Boston: IEA.

National STEM Centre. (2011). **Higher Education in STEM subjects inquiry launched**. (National STEM Centre) Retrieved from <http://www.nationalstemcentre.org.uk/news/higher-education-in-stem-subjects-inquiry-launched>.

Bibliography

Northern Ireland Executive. (2012). **Programme for Government 2011-15**. Belfast: Northern Ireland Executive.

Northern Ireland Assembly. (2012). **Report on the Committee's Inquiry into Developing the Northern Ireland Economy through Innovation, Research & Development**. Belfast: Northern Ireland Assembly.

Northern Ireland Assembly. (2012, May 24). **Report on the Committee's Inquiry into Developing the Northern Ireland Economy through Innovation, Research & Development**. Retrieved August 18, 2014, from Northern Ireland Assembly: <http://www.niassembly.gov.uk/Assembly-Business/Committees/Enterprise-Trade-and-Investment/Reports/Report-on-the-Committees-Inquiry-into-Developing-the-Northern-Ireland-Economy-through-Innovation-Research--Development/>

Northern Ireland Assembly. (n.d.). **Assembly Business**. Retrieved from Northern Ireland Assembly: <http://www.niassembly.gov.uk/Assembly-Business/Committees/Enterprise-Trade-and-Investment/Reports/Report-on-the-Committees-Inquiry-into-Developing-the-Northern-Ireland-Economy-through-Innovation-Research--Development/>

Northern Ireland Audit Office. (2013). **Improving Literacy and Numeracy Achievement in Schools 2**. Belfast: Northern Ireland Audit Office.

Northern Ireland Executive. (2011). **Northern Ireland Economic Strategy**. Belfast: Northern Ireland Executive.

Northern Ireland Executive. (2012). **Economy and Jobs Initiative**. Belfast: Northern Ireland Executive.

Northern Ireland Executive. (2014). **Programme for Government 2011-15**. Belfast: Northern Ireland Executive.

Office of the Chief Scientist. (2013). **Science, Technology, Engineering and Mathematics in the National Interest: A Strategic Approach**. Australian Government.

Office of the Press Secretary. (2013). **Remarks by the President on the 150th Anniversary of the National Academy of Sciences**. (The White House, Washington) Retrieved from <http://www.whitehouse.gov/the-press-office/2013/04/29/remarks-president-150th-anniversary-national-academy-sciences>

Perry, C. (2012). **Research and Information Service (STEM)**. Belfast: Northern Ireland Assembly.

RSM McClure Watters (Consulting). (2013). **Advanced Manufacturing and Engineering Services Skill Needs**.

Sainsbury, D. (2007). **The Race to the Top**. London: HM Treasury.

Smart Futures. (2014). **Smart Futures Strategy 2014-2016**. Dublin.

Smolaks, M. (2013, June 20). **Springtown – A Hard Drive Factory Like No Other**. (TechWeek Europe) Retrieved March 24, 2014, from <http://www.techweekeurope.co.uk/news/springtown-a-hard-drive-factory-like-no-other-119580?pid=1394#gallery-nme>

The National Foundation for Educational Research. (2012). **Key Competences in the curriculum – Northern Ireland**. Berkshire: The National Foundation for Educational Research.

Urc, I. (2011). **One Plan Derry~Londonderry**.

Wheate, R., Wheeler, R., Burge, B., & Sizmur, J. (2012). **PISA 2012 National Report**. London: Department for Education.

North West STEM Action Plan

March 2015