



Smart Futures Strategy 2014-2016:

A collaborative framework to drive awareness of careers in science, technology, engineering and maths (STEM) at post-primary level.

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1. Background

Smart Futures is a collaborative government-industry framework promoting science, technology, engineering and maths (STEM) careers to post-primary students in Ireland. It aims to improve the strategic coordination and alignment of industry outreach resources and drive the uptake of students selecting STEM subjects at post-primary and third level.

Smart Futures began as a pilot in late 2011 following a previous ‘Science in Schools’ initiative and is now part of the Government’s Action Plan for Jobs. It is coordinated by SFI Discover (formerly Discover Science & Engineering), the education and outreach programme of Science Foundation Ireland (SFI), in partnership with Engineers Ireland’s education outreach programme, STEPS.

To-date Smart Futures has worked with over 50 STEM-related organisations, directly engaging over 28,000 students. Using the learnings and successes of this outreach activity, SFI has committed to driving this framework forward in association with partners such as PharmaChem Ireland, the Royal Society of Chemistry, ICT Ireland and the Institute of Physics.

Data gathered by the Higher Education Authority (HEA) shows that the overall number of CAO applications in Ireland across all subject areas in 2012 was approx. 72,000, while the number of graduates across the various STEM-related courses (at all levels) was approx. 21,000¹ in the same year.

CAO applications to programmes in engineering and science constituted 4.6% and 7.5% of overall first preference applications, both increases from 2012. A detailed analysis of CAO preferences carried out by the HEA revealed that applications to technology courses constituted more than 20% of all first preference applications.

The number of post-primary students taking STEM subjects for their Leaving Certificate² increased marginally in 2012-2013 by 1.7% - a full break down can be seen in Appendix I.

¹ <http://www.hea.ie/en/statistics/2011-2012>

² <http://www.examinations.ie/index.php?!=en&mc=st&sc=r13>

Over 13,000 students took higher maths, up from 8,235 in 2011, an increase much attributed to the introduction of bonus points.

Leaving Certificate results in STEM subjects 2012 and 2013

Higher + Ordinary	2012	2013
Maths	50,443	50,856
Biology	30,541	31,500
Chemistry	8,086	8,155
Agri Science	6,889	7,414
Physics	6,373	6,448
Engineering	4,837	4,881
Applied Maths	1,490	1,599
Technology	924	1,075

There is continued demand for graduates with STEM qualifications, particularly in the areas of medical devices, renewable energy and ICT. Ensuring post-primary students are engaged and educated about STEM careers opportunities is key in encouraging them to pursue third level STEM courses and working in STEM-related sectors.

With partner organisations working together under the Smart Futures umbrella, the framework proposes a series of strategic steps for better coordination of the delivery of STEM careers resources, to achieve a more effective means of evaluation and greater impact.

2. Vision

The Smart Futures framework seeks to drive a more coordinated approach in addressing STEM skills needs and the better use of resources, while ensuring the delivery of high quality STEM careers supports to students, teachers, parents, guidance counsellors, industry and the media.

3. Mission

The Smart Futures framework encourages the take up and retention of STEM subjects among post-primary students, through a coordinated national awareness programme. It also encourages students to pursue STEM subjects at third level and communicates the variety of STEM career opportunities to students, teachers and parents.

4. Aim

The Smart Futures framework aims to:

- Support industry and education partners to create greater awareness of STEM careers
- Provide careers information to parents, teachers and guidance counsellors
- Better coordinate STEM careers outreach already taking place and identify gaps so that industry and other partners can respond to these
- Contribute significantly towards increasing the number of post-primary students choosing STEM-related subjects for Junior and Senior Cycle and the number of students pursuing STEM-related courses at third level
- Create more opportunities for student engagement e.g. TY programmes
- Review programme targets and actions/KPIs periodically

5. Engaging Industry

To-date over 50 organisations from across the STEM sectors have worked with SFI in delivering STEM outreach supports for post-primary students, teachers and guidance counsellors. These industry partners provide valuable in-kind support, such as access to staff for career panels and school talks. The benefits of such collaboration between industry and government are:

- To effectively coordinate existing STEM careers promotion activities and avoid any duplication of effort by industry partners

- To leverage STEM careers activities that are taking place on a national scale for greater impact and to improve the evaluation of such activities
- To provide industry with support mechanisms such as volunteer training etc.
- To highlight skills needs identified by STEM industry partners and areas of opportunity with a high demand for STEM graduates
- To showcase the positive story of STEM sectors that are thriving in Ireland and work with the media to relay this story to parents, teachers and guidance counsellors
- To encourage and inspire more students to study STEM-related subjects and pursue STEM courses at third level
- The opportunity to be part of a national framework that can be recognised on a European level

It is proposed that partnership with the Smart Futures network would become a key objective for any organisation that has a strategic interest in an increase in the quality and availability of STEM graduates in Ireland. This may fall within their corporate social responsibility (CSR) remit, education and outreach programmes, or even as part of a long term strategic HR recruitment drive.

Smart Futures will look for outreach activities and channels that can be utilised to connect industry to parents and students in non-education settings (e.g. St. Patrick's Day Festival, Science Week, BT Young Scientist). SFI funding calls will also consider how funding can be allocated to leverage existing or new initiatives that can help achieve this.

Smart Futures is working closely with partners such as PharmaChem Ireland and the SFI-funded STEPS programme in Engineers Ireland, to deliver STEM support and resources to schools. To-date in the 2013-14 academic year, 432 STEM volunteers have been trained to deliver their career story to young students, resulting in 427 schools receiving Smart Futures career talks. This activity has directly engaged with approx. 15,270 students nationwide.

Smart Futures is proposing to further grow this volunteer programme between 2014 and 2016, with the development of a database of volunteers with STEM backgrounds. This database will complement the STEPs engineer's volunteer database and STEPs will use the best practice they have developed to-date in this area to help facilitate volunteer training. Smart Futures also has access of up to 3,000 researchers through seven new SFI funded

centres and other institutions, as well as education outreach officers, who will also be invited to join this volunteer network.

It is aimed to have 450+ volunteers trained by end of 2016 giving every school in the country the opportunity to request a visit per year. All volunteer activity will be evaluated and a 'Volunteer of the Year Award' will be given to the volunteer that has participated most regularly and received consistently good feedback, by way of recognition.

All Smart Futures volunteers will receive the same core training on communications skills, child protection and messaging on STEM skills. This coordinated approach enables us to offer a quality service to schools nationwide, as well as providing volunteer speakers with a high standard of training; consistency of messaging and effective evaluation mechanisms.

6. Engaging with Education

The Smart Futures framework can offer education a one-stop shop for high quality, credible and industry approved STEM careers supports and resources. The programme can provide education with structured industry engagement and the ability to feedback through evaluation mechanisms.

Through the expansion of the STEM volunteer database, Smart Futures seeks to provide schools with access to STEM professionals from an array of diverse career areas, giving students examples of role models and the opportunity to hear real-life STEM career stories. There is a limited amount of time that schools have to accommodate volunteer visits, so this must be used to the best effect, communicating clear and broadest messages.

It is important that consideration is given to the challenges facing teachers and guidance counsellors and their expectations where STEM careers promotion is concerned.

At primary school level there is often more time in the school day for exploring topics such as the different jobs that people might have working in STEM roles, however at post-primary

level students often will not have the opportunity to explore careers until transition year (where that is available) or later at senior cycle.

To feasibly affect change in the numbers of students taking STEM subjects for senior cycle, Smart Futures will work to support and encourage teachers to introduce STEM careers information before they make their final subject choices for senior cycle. Smart Futures will also seek to review best practice in other countries in the same space with the aim of emulating what is successful or can be replicated in Ireland where appropriate. Smart Futures will engage with teacher groups at events such as the Irish Guidance Counsellors Annual Conference, ISTA events, Higher Options etc. and provide workshops, talks and materials where possible.

Good quality resources and supports such as volunteer visits, careers materials and industry talks to attend will be offered to teachers and Smart Futures will gather feedback from all interactions to improve where possible. It is acknowledged that third level institutions need to engage with post-primary schools and give students the opportunity to hear from older students studying STEM at third level to encourage peer-to-peer influence and support.

Work is being done by SFI Research Centres and funded researchers in third level institutions, to connect post-primary students to third level, through open days and schools programmes. It is aimed to strengthen these outreach activities (including TY placements) with a more coordinated approach. Smart Futures is also working with the SFI Discover funded STEPS programme to support their 'Engineering Your Future' TY programme in third level institutions.

Smart Futures will also continue to promote female role models in STEM to help encourage younger female students. This includes website content, videos and presence at careers events, as well as having significant numbers of female volunteers to go into schools. Through the annual SFI Discover funding calls support can be provided to projects that meet criteria under certain themes, such as the promotion of STEM careers. Funding of this nature can be allocated to leverage existing or new initiatives that can help achieve Smart Futures targets.

It is proposed that a national STEM survey would be circulated to all undergraduates in higher level education institutes to query students on the key indicators that influenced their CAO choices to identify why they did or did not pursue STEM courses at third level. The data collected should provide insights into the decision making process and highlight opportunities for Smart Futures to play a role.

While Smart Futures is not directly involved in curriculum, it is recognised that students can benefit from hands-on experience. Smart Futures will work with volunteers to carry out interactive, hands-on science demos during school visits and provide volunteers with materials and training to support this activity.

An online repository of hands-on activities that can be accessed by volunteers and teachers will be compiled on the website. Smart Futures will also work with the SciFest programme to encourage students participating in projects to inform themselves about STEM careers and will highlight the project work being carried out by them on www.SmartFutures.ie.

7. Engaging the public, families and the media

There are a number of ways in which Smart Futures can connect with the general public, families and the media to help raise awareness about STEM careers among school students in Ireland.

Public facing awareness festivals such as Science Week, Engineers Week and Maths Week have a national reach with a strong regional presence, bringing local communities together. They present valuable opportunities for industry partners and third level organisations to connect with students, teachers, guidance counsellors, parents and local media to celebrate and explore STEM-related topics.

Media will be engaged to highlight the career opportunities in STEM areas on an on-going basis, but also particularly during the awareness festivals already outlined and at key dates in the education calendar such as:

- CAO choices and CAO ‘change of mind’ dates
- Junior Cert and Leaving Cert exam and results dates

Industry partners have the opportunity to coordinate and strengthen messaging about STEM careers by working together under the Smart Futures umbrella. Ultimately the media should perceive the Smart Futures programme as the ‘go-to’ for STEM careers information and commentary during these key dates. There are opportunities for industry partners to act as spokespeople for STEM careers and skills needs on such occasions.

Messaging within media communications needs to be current and appropriate for each audience being targeted and will be evaluated on an on-going basis to stay relevant and accurate.

SFI will work with the Broadcasting Authority of Ireland and other partners to catalyse a transformation in scientific coverage and programming, particularly that which highlights Irish STEM stories, across all media platforms. It is proposed that Smart Futures will engage with industry partners and research centres to give the media access to people working in STEM to provide them with content as required.

8. Smart Futures Advisory Group

It is proposed to bring together a number of industry, education and government representatives to participate in an advisory group, which would meet twice yearly.

This group will provide a platform for gathering feedback from participating partners who have a strategic interest in increasing the number of STEM graduates in Ireland. The role of the group will be:

- To input into the Smart Futures strategy as laid out in this draft document, with particular regard to its goals, objectives and annual delivery plans
- To review past activities and propose new activities where appropriate
- To assist in recruiting additional industrial, academic or other partners

- To disseminate any useful learnings or information from company outreach activities in other countries
- To consider and advise how industry and education can best engage and participate
- To consider the on-going funding and resourcing of the Smart Futures programme, in relation to its growth and sustainability going forward

The Smart Futures Advisory Group allows for representatives of different sectors to come together to feed into a strategy that aims to help increase the overall pool of graduates that all sectors will ultimately benefit from. The Group is a forum for organisations to share best practice with as well as to flag issues identified in their sector, to work together to find potential solutions. Smart Futures is open to working to highlight specific areas of need, but has a commitment to retaining a balanced perspective across the STEM sectors.

It is envisaged that the industry representatives on the Advisory Group will support the call for inputting into careers content such as STEM career pathways information. Industry forums and SFI research centres will also be utilised to invite other industry partners to participate in the development of this content.

While it is beyond the scope of Smart Futures to collate all STEM outreach happening definitively across the country throughout the year by all STEM organisations, it is proposed that all members of the Advisory Group would share information on their outreach activities and that regular calls would be put out to wider industry to inform us of their activities.

9. Actions, KPIs and Goals

The following is a list of the specific actions proposed by the Smart Futures framework to carry out by 2016:

1. To provide an online registration system for schools and industry partners which will enable us to gauge the level of engagement and provide a formalised communication channel

2. To set measurable objectives relating to student awareness of STEM careers opportunities
3. To carry out comprehensive evaluation to assess the impact of the outreach activities of the Smart Futures programme
4. To significantly grow the database of STEM ambassadors (i.e. STEM employees discussing their career stories, their disciplines and life in STEM)
5. To integrate the SFI Speakers for schools database and the database of researchers with this expanded Smart Futures volunteer network
6. To be able to provide every school in the country with a talk from a STEM volunteer
7. To provide training and inductions for volunteers to enable them to give career talks in schools and gather feedback from schools that have received talks
8. To connect career talks to any relevant areas of the STEM Curriculum where possible
9. To develop quality online content for students, parents, teachers and guidance counsellors

Smart Futures framework: key performance indicators

KPI	Direct or indirect	Goal
The number of partner companies that have signed up	Direct	To increase the number of partner companies participating by over 50% by 2016
The number of schools registered and the number of students engaged	Direct	To increase the number of schools and students participating by 30% by 2016
The number of STEM volunteers registered and trained	Direct	To grow the database and deliver training to 450+ volunteers and be able to provide a Smart Futures visit to every secondary school in the country by 2016

The number of school visits recorded and feedback retrieved Results of the student attitudes towards STEM careers survey at BTYS	Direct	To implement comprehensive evaluation across all Smart Futures-related activities
The number of Smart Futures STEM careers roadshows and talks delivered	Direct	To deliver Smart Futures STEM careers roadshows to regional locations throughout the year
The availability of an online repository of hands-on activities	Direct	To create a repository of hands-on activities for volunteers to access and use during school visits - ideally mapped to the curriculum
The level of uptake of STEM subjects at second and third level	Indirect	To contribute significantly towards halting the decline observed over 2007-11 and aim to increase uptake by 10% by 2016

10. Conditions for success and growth

The following list of conditions is a prerequisite for the success and growth of the Smart Futures framework:

- Commitment and buy-in from industry, schools and third level institutions
- Forging of direct links between schools, third level institutes and industry
- Harnessing enthusiasm and promoting a professional approach for volunteers
- Giving students more hands-on experience and access to experts
- Comprehensive evaluation of all STEM promotion activities being carried out under the Smart Futures brand to measure their impact
- Mapping the schools that are participating and identifying those that are not across the country, so as to ensure all schools are actively engaged
- Working with students and schools to develop resources and supports that they feel would benefit them.

11. Implementation

The Smart Futures framework seeks to fulfil the remit for increasing the number of STEM graduates in Ireland within the government's Action Plan for Jobs and SFI's Agenda 2020³ document.

SFI will drive the fulfilment of the objectives of the framework, in partnership with industry, education and outreach organisations, under the guidance of the Advisory Group.

SFI will provide the management and administration of the website www.SmartFutures.ie; the expansion and training of the STEM volunteer network; media and PR requirements and communications materials to schools.

SFI has committed to co-funding, supporting and facilitating the Smart Futures partners to work together to identify skills gaps and increase the awareness of STEM careers opportunities in Ireland among students.

³ <http://www.sfi.ie/assets/files/downloads/News%20and%20Events/AGENDA%202020.pdf>

Appendix I: Breakdown of Leaving Certificate results 2012-13

2012 Leaving Certificate Statistics – Higher Level

	Female	Male	Total
Applied Maths	307	1,037	1,344
Physics	1,279	3,474	4,753
Maths	5,159	5,972	11,131
Chemistry	3,672	3,033	6,705
Physics & Chemistry	132	177	309
Ag Science	2,256	3,331	5,587
Biology	14,056	8,684	22,740
Engineering	172	3,647	3,819
Construction Studies	376	6,199	6,575
Technology	142	628	770
Total	27,551	36,182	63,733

Total STEM Higher Level 2012: 63,733

2012 Leaving Certificate Statistics – Ordinary Level

	Female	Male	Total
Applied Maths	52	94	146
Physics	302	1,318	1,620
Maths	17,199	16,717	33,916
Chemistry	672	709	1,381
Physics & Chemistry	29	67	96
Ag Science	393	909	1,302
Biology	4,467	3,329	7,796
Engineering	63	995	1,018
Construction Studies	133	1498	1,631
Technology	32	123	155
Total	23,342	25,759	49,061

Total STEM Ordinary Level 2012: 49,061

***Total STEM for both levels 2012: 112,794**

2013 Leaving Certificate Statistics – Higher Level

	Female	Male	Total
Applied Maths	337	1133	1,470
Physics	1,243	3,589	4,832
Maths	6,069	6,945	13,014
Chemistry	3,658	3,098	6,756
Physics & Chemistry	131	199	330
Ag Science	2,384	3,567	5,951
Biology	14,185	9,251	23,436
Engineering	156	3,586	3,742
Construction Studies	392	6,180	6,572
Technology	158	787	945
Total	28,713	38,335	67,048

Total STEM 2013 Higher Level: 67,048

2013 Leaving Certificate Statistics – Ordinary Level

	Female	Male	Total
Applied Maths	31	98	129
Physics	278	1,338	1,616
Maths	16,271	15,894	32,165
Chemistry	670	729	1,399
Physics & Chemistry	24	69	93
Ag Science	408	1,055	1,463
Biology	4,478	3,586	8,064
Engineering	77	1,062	1,139
Construction Studies	131	1,410	1,541
Technology	24	106	130
Total	22,392	25,347	47,739

Total STEM 2013 Ordinary Level: 47,739

***Total STEM uptake across both levels in 2013: 114,787**

Percentage difference between 2012 and 2013: 1.7% increase