Towards a STEM Education Policy Statement and Implementation Plan for Schools

Background

The Department of Education and Skills is engaging in consultation with stakeholders to develop and implement a STEM (Science, Technology, Education and Mathematics) Education Policy Statement and Implementation Plan for Schools, hence referred to as the STEM Policy Statement. The Department's work in this area is being informed by the STEM Education in the Irish School System report[1], hence referred to as the STEM Report, which was published by the STEM Education Review Group in November 2016. This report drew upon the expertise of many individuals and organisations and involved significant consultation with a broad range of stakeholders. The STEM Education Review Group's Terms of References focused on *five* issues across Primary and Post-Primary education:

1. The preparation of teachers (at first and second level) for STEM education (so-called Initial Teacher Education).
2. The best methods of supporting the current cohort of STEM Teachers already in the system, with a particular focus on Continuing Professional Development.
3. The introduction of new teaching and learning modalities that would enhance STEM education.
4. The use of digital technologies to enhance learning.
5. The promotion of STEM careers and methods to enhance the engagement of students in STEM subjects.

The STEM Report was commissioned by the Department to identify deficits in and to make recommendations to enhance the quality of STEM education. The report outlines the extent of the economic and job opportunities for Ireland that are dependent on high quality STEM education, and highlights the need for certain changes within our education system if we are to compete on an international level. The Minister for Education and Skills has welcomed the Report and has prioritised 21 of the 47 actions identified. These actions will inform the creation of the STEM Policy Statement and Implementation Plan.

The promotion of STEM within our education system is a key priority for the Department and is reflected in multiple strategy documents, such as the Action Plan for Education, the National Skills Strategy and the Digital Strategy for Schools. The Department is already actively engaged in promoting STEM across the education system for example through the updating of existing STEM curricula and in working with outside organisations to promote STEM among all learners.

The STEM Report has highlighted a range of additional actions that could also be included in our new STEM Policy Statement and the Department wishes to consult with partners on these actions, with a view to creating a world class STEM Policy Statement for Ireland. In addition, the Department and our relevant agencies are reviewing STEM implementation in other countries.

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[1] STEM Education in the Irish School System report, https://www.education.ie/en/Publications/Education-Reports/STEM-Education-in-the-Irish-School-System.pdf

Consultation on Implementation

In developing the STEM Education Policy Statement and Implementation Plan, the Department is keen to gather the views of our stakeholders on proposed actions and how these might best be implemented within the system. The Department will invite stakeholders to review the following statements and consider the questions posed in relation to each.

Theme 1: Preparation of Teachers for STEM education in Ireland

The following actions from the STEM report are designed to enhance the knowledge and practice of all teachers entering initial teacher education (ITE) programmes, so we attract more students who have taken STEM subjects to a high level in to the profession, while also deepening the STEM knowledge of all preparing to become teachers.

Consider how the following actions could improve the preparation of teachers for STEM education.

1. Consider the following actions in relation to ITE and how they might improve teacher preparation:
    i) Students of ITE (primary) programmes should undergo an audit of subject-matter knowledge (SMK) in STEM subjects (mathematics and science) over the course of their programme. Self or peer-evaluation may be helpful in this regard. Supports should be provided to ensure that students address deficits in their knowledge e.g. mathematics-learning support.
    ii) Require all primary teachers in ITE to pass all STEM-methodology-related subjects (without compensation) in final examinations, where this is not currently the case.
    iii) Include a formal consideration of STEM education during mentoring of student teachers during their primary school placement.
2. The development of specialist STEM teachers ('STEM Champions') should be encouraged in primary schools. Such specialists would work with colleagues to disseminate insights and best practice in STEM Education. A 'STEM Champion' should hold a recognised postgraduate qualification (e.g. in Mathematics Education, Science Education, Technology Education, STEM Education). Support should be provided to primary teachers to gain such qualifications.
3. Support the active engagement of schools with STEM-related industries across a broad range of fronts (e.g. the possibility of optional placements in STEM industries during primary and post-primary teacher preparation phases should be explored).

Theme 2: Supporting STEM Teachers within the system (with a particular focus on Continuing Professional Learning (CPD)

The following actions from the STEM report are designed to enhance the quality of those within the teaching profession by supporting STEM teachers so they can constantly enhance their professional STEM practice and knowledge throughout their careers.

Consider how the following actions could improve how we support teacher professionalism within the system:

1. Support STEM teachers (primary and post-primary) financially and through appropriate career opportunities to embrace CPD and lifelong learning in their STEM disciplines (and related pedagogy) as a means of advancing their professional development.
2. Develop a common currency for assessing and accumulating CPD elements in STEM education for accreditation purposes. Such currency units (such as credits or points) should be used in defining professional recognition from the Teaching Council.
3. Link formal and informal STEM education providers under a national initiative, such as SFI Discover, to create opportunities for non-traditional CPD for STEM teachers (e.g. museums, zoos, science galleries).

The introduction of new teaching and learning modalities that would enhance STEM education in our schools and for which there is a strong evidence base.

The following actions from the STEM report are designed to enhance student engagement and participation in STEM, both within and outside of formal school settings.

Consider how the following actions could support the introduction of new teaching and learning modalities to enhance STEM education in our schools:

1. Develop a means of recognising participation in informal (extra-curricular) STEM events and activities (e.g. Science Fairs, BTYSTE, SciFest, CoderDojo, Intel MiniScientist) into the STEM curriculum and assessment at Primary and Post-primary levels, e.g. in an e-portfolio of achievement. Such digital archives of learning and personal development need to become part of the assessment for learning. The model used for the Science Foundation Ireland Discover Primary Science and Maths programme at primary school could be explored.
2. Promote real engagement with fundamental science concepts and principles through application to real-life situations and practical work.
3. Foster evidence-based STEM education research in Ireland in order to support the introduction of new modalities in STEM teaching, learning and assessment.

Theme 4: The use of technology to enhance STEM learning

The following actions from the STEM report are designed to embed digital technologies within STEM so that teachers and learners can utilise modern technologies to support their learning.

Consider how the following actions could support the use of technology to enhance STEM learning:

1. Support the introduction of digital technology to facilitate international collaboration in STEM subjects between schools, and between schools and research facilities (e.g. remote telescopes, remote laboratories).
2. Exploit digital technology in promoting and facilitating new engagements between schools and enterprises, e.g. the use of online mentors to assist schools/learners with their STEM activities; using digital technology to bring real science and engineering into the classroom; new forms of CPD to educate teachers in computer science.

Theme 5: The promotion of STEM careers and the identification of methods to enhance the engagement of students in STEM subjects

The following actions from the STEM report are designed to promote STEM in general and to entice more students, particularly females, into STEM courses and careers now and into the future.

Consider how the following actions could support the promotion of STEM:

1. The promotion of STEM is deemed to be extremely important, please consider the following actions and how they might raise awareness of STEM among all in society, particularly students and their families?
   i) Ambitious targets and a sustained, multi-faceted action plan for addressing the gender imbalance in STEM disciplines should be established and implemented as a matter of urgency.
   ii) Identify and promote the range and diversity of career opportunities available to STEM graduates as early as possible in primary and post-primary schools.
   iii) STEM disciplines should be promoted as being crucial to personal development and citizenship in the 21st century.

2. STEM curriculum and assessment should be linked to wider ethical, legal, and societal issues, such as STEM's role in addressing global challenges (food, water, and energy security; biodiversity loss; etc.).
3. Promote and facilitate the 'adoption' of a school, or a cluster of schools, by a local STEM industry/enterprise.

Theme 6:   Conclusions and general recommendations proposed in the STEM Report

The following overarching actions from the STEM report are aimed at ensuring Ireland has a high-quality graduate output aligned with national economic needs now and into the future.

1. Establish the STEM 2020 Partnership - a fixed-duration, public-private (enterprise-exchequer) partnership to create a fund to support a prioritised set of agreed, specific initiatives consistent with the recommendations of this report. This would entail pooling of resources from enterprise partners, philanthropy and crowdsourcing with resource-matching by the exchequer (DES, DJEI, SFI) over a five-year period. A fund of €8M per annum for five years, equally subscribed from public and private interests, is envisaged.
2. Establish STEM education research as a national research priority with sustained funding through SFI.
3. Create an annual 'Excellence in STEM Teaching' award scheme to recognise those teachers who are pioneering innovations in STEM education and who are outstanding educators.
4. The STEM Policy Statement should go beyond Science, Technology, Engineering and Mathematics to take account of the role of the Arts. Thus, the acronym STE(A)M should be considered, where A represents the Arts and Design (including design thinking).

The Consultation Process

The Consultation Process will gather the observations of stakeholders, in relation to the above actions, by posing the following questions:

- Are the actions clearly articulated and if not, how they might be further enhanced?
- Are the actions achievable and who needs to be involved in order to achieve success?
- What might success might look like in relation to the above actions and are there any good examples or models that can inform their implementation?
- Are there any other actions that should be captured in the STEM Policy Statement?

The Department will engage in both face-to-face and online consultation around these actions. We will meet with a sample of parents and students at post-primary and primary schools to discuss the actions under Themes 3, 4, 5 and 6 while consultation with other stakeholders will focus on all 6 themes. In addition, the Department will develop an online survey to gather the views of the wider public in relation to these proposed actions.

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Stakeholders are invited to provide feedback via an online survey at:

www.surveymonkey.com/r/STEMPolicy2017

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