Irish Science Teachers' Association

Eol-Oidí na hÉireann

Roundtable Discussion on the Future of Science, Technology, Engineering and Mathematics (STEM) in Irish Education.

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A Cathaoirleach,

The Irish Science Teachers' Association is very grateful for the opportunity to speak with you, the committee members and the representatives from the Irish Maths Teachers' Association (IMTA) and the Engineering Technology Teachers Association (ETTA) today on the future of STEM Education in Ireland.

Briefly, some background on the ISTA: The ISTA was founded in 1961 and has a current membership of approximately 1500 science teachers. The ISTA Council consists of an Executive and representatives of the 15 branches from right across the country. The ISTA is active in the promotion of science education amongst our members and their students, and we run monthly activities for students and teachers right throughout the country. In addition, we run a national online Continuing Professional Development (CPD) programme throughout the year for teachers who are unable to attend their local branch events. All of our events take place outside of school time and are run on a completely voluntary basis. We also hold a national conference once a year, usually just after the completion of this term.

STEM Education in Ireland

Education in Science, Technology, Engineering and Mathematics (STEM) plays a vital role in preparing Irish second level students for the challenges of today's society. As our world becomes more technologically advanced, there is a growing need for a STEM-literate population that can contribute to innovation and problem-solving. The skills developed through STEM education are not only essential for success in traditional STEM careers but are also increasingly necessary in other fields such as healthcare, finance, and even the arts.

Moreover, a STEM-literate population can help Ireland meet the challenges of the 21st century, such as climate change, public health, clean water and food production, and sustainable development. STEM education equips students with the tools to understand complex scientific and technological

issues, as well as the skills to analyse data, develop evidence-based solutions, and communicate their ideas effectively.

Furthermore, STEM education encourages creativity and entrepreneurship, which are essential for Ireland's economic growth and development. In today's rapidly changing economy, innovative ideas and technological advancements are crucial for businesses to stay competitive. STEM education fosters a culture of innovation and entrepreneurship, preparing students to contribute to Ireland's growing tech industry.

In addition, STEM education can help to address societal inequalities. Women and minorities are often underrepresented in STEM fields, and STEM education provides opportunities to address this imbalance by promoting diversity and inclusivity in STEM-related careers.

No doubt all in attendance here today agree that STEM education is of great importance to Irish second level students, not only for their future careers but also for the challenges facing today's society. A STEM-literate population can contribute to innovation and problem-solving, help to address societal inequalities, and foster Ireland's economic growth and development.

STEM Education Implementation Plan to 2026

Earlier this month, Education Minister Norma Foley launched the 2nd Implementation Plan for the STEM Education Plan 2017-2026. The plan outlines the government's commitment to promoting STEM education across all levels of education, from early childhood to higher education. The policy statement highlights the importance of science education and the need to create a science curriculum that is relevant, engaging, and promotes the development of critical thinking, problem-solving, and scientific literacy skills.

As you know, the plan has four key pillars, including pillar 3 - Support STEM Education Practice – and pillar 4 – Use Evidence to Support STEM Education. There is a commitment to a "*continued review of STEM curriculum and assessments across all levels*" and to conduct research on identifying "*opportunities and barriers that currently exist".*

We are glad to hear that research will be conducted but are perplexed that this did not precede the development of the current syllabus or specification design models.

It is the current view of the ISTA, based on our own research, and research commissioned by us, as well as a review of international best practice, that the current model of curriculum development and syllabus design does not meet the needs of teachers and their students, and forms a significant barrier to the implementation of the STEM Education Plan.

Curriculum Development

The ISTA welcomed the committee's key recommendation in their report in May 2022 on **Leaving Certificate Reform: The Need for a New Senior Cycle** which stated:

"As part of senior cycle reform, a key priority for the Department of Education must be that the revised syllabus for each subject is far more detailed with comprehensive instructions for teachers.

The Committee recommends that the NCCA reviews the proposed design of the new syllabi to ensure teachers are properly supported and students taught to the highest professional standards".

It is imperative that the current flawed template of syllabus design be replaced with a template which reflects international best practice and where there is ample evidence that the template has been successfully implemented.

The syllabus is the bedrock on which STEM education practice is built upon in schools, and beyond. If this syllabus is not well constructed, then successful implementation of the subject will not take place. Sadly, we have experienced the effects of a poorly constructed, vague syllabus on our students, with the revised Junior Cycle Science in 2016 and again with Senior Cycle Agricultural Science in 2019. The redevelopment of the Senior Cycle science curricula (Biology, Chemistry & Physics) provide opportunities to address the issues with the design of these curricula.

Junior Cycle Science

The current Junior Cycle Science specification was drafted quickly and involved limited consultation. The term "specification", as used by the NCCA to describe syllabi in recent years, is a misnomer; whilst the term has been borrowed from the UK, the specifications published by the NCCA, in fact, lack specificity and contain far less detail compared to the syllabi published in the UK.

Thus, a "specification" should be a detailed document. The NCCA has taken the opposite view, with specifications utilising a learning outcomes model. The Junior Cycle Science specification contains 46 learning outcomes while Leaving Certificate Agricultural Science contains 91. The learning outcomes are often vague and provide little additional support meaning teachers struggling to interpret what students should know, understand and be able to do on completion of each learning outcome.

In 2019, the ISTA published the report *Listening to the Voice of Science Teachers* after an extensive survey of our members. This report highlighted the major problems encountered by science teachers arising out of their experience of teaching the Junior Cycle science syllabus. Among the problem highlighted were:

<u>1. The lack of clarity on the depth of treatment of topics on the syllabus.</u>

It is simply not possible to compress an entire three year Science programme into 46 learning outcomes. The learning outcomes lacked clarity, with teachers finding it difficult to agree on the depth of treatment required by the specification. It was also apparent that the State Examinations Commission's interpretation of the depth required differed from that of the NCCA and the teachers tasked with implementing the specification in the classroom. Despite numerous requests, no additional detail has been provided by the NCCA on the depth required.

<u>2. Inadequate Training</u>

Many teachers felt the training provided during the implementation of the new specification, at the early stages in particular, was not fit for purpose. Teachers were encouraged to "unpack" learning outcomes collaboratively but this further added to frustration as it was clear that the model lent

itself to inconsistencies. In spite of inclusion of new topics such as evolution, formation of the universe, celestial bodies and aspects of genetics, there was no guidance on the depth of coverage needed to satisfy the needs of the examination. The teams tasked with implementing the training avoided the content of the specification and concentrated on topics tangential to the syllabus.

3. The lack of value placed on practical work.

In the "old" Junior Certificate Science syllabus, 35% of the total marks were awarded for laboratory practical work. The new 2016 syllabus has very few student experiments specified and no credit is given by the SEC for student laboratory work as part of the final assessment of Junior Cycle science. The lack of a set of mandatory experiments specified in the syllabus is a major problem as there is no guarantee that all students will acquire key laboratory skills.

4. Lack of Contact Time

Other issues that arose with the implementation of the revised Junior Cycle science syllabus was the cut to the minimum teaching time from 240 hours to 200 hours. In reality, this means that in many schools the time allocation for science was cut from five forty minute periods to three periods per week as schools were obliged to spend so much extra time on the topic of wellbeing.

5. Lower Standard of Content Knowledge

There was concern that the standard of scientific knowledge required by the students was significantly lower than in the previous syllabus. Many felt the new course had "dumbed down" Science.

6. Wider Gap Between Junior & Senior Cycle Sciences

There was significant concern that the gap between Junior Cycle Science and Leaving Certificate Biology, Chemistry and Physics had widened since the introduction of the new Junior Cycle specification, principally down to the lowering of standards in Science.

Senior Cycle Subject Development

The learning outcomes model has also been used by the NCCA in the development of Leaving Certificate subjects such as Computer Science, Agricultural Science and Politics & Society. Research has shown that teachers have experienced similar problems to those encountered at Junior Cycle level, e.g. lack of clarity on the depth of treatment, lack of effective CPD, lack of clear guidance on the correct implementation of the syllabus, lack of timely sample examination papers and unexpected areas being examined on the final examination papers. An extensive survey by the Irish Agricultural Science Teachers' Association was damning in its assessment of the NCCA's model, with just 0.4% of the teachers surveyed (a total of 278) describing the learning outcomes as 'very clear'. On the other end of the five point scale, 46% of respondents described the learning outcomes as 'not very clear'.

A number of schools have since removed Agricultural Science from their curriculum as teachers are unclear as to the precise content of the specification. The numbers of students taking Agricultural

Science has dropped by 13% in the past two years, at a time when the total number of students completing the Leaving Certificate has increased.

STEM are perceived as 'difficult' subjects in their own right. We do not want to add to this perception by being forced to teach inadequate syllabi, inadequate CPD training and support as well as lack of alignment between examination papers and syllabi. Unless this problem is tackled and resolved, we will certainly see a decline in students opting to take STEM subjects at Senor Cycle.

ISTA's Key Objectives

The ISTA would like to reiterate our own commitment to supporting Ireland's STEM Education Plan but feel the current syllabus design model is a significant barrier to achieving its ambitions goals. We would like the committee to reiterate that the following are needed for the successful implementation of STEM subjects.

1. A new syllabus template needs to be developed for all syllabi at Junior Cycle and Leaving Certificate level. This template must contain more detailed information about the depth of treatment required, including the linking of learning outcomes to teaching and learning activities and to assessment. As the syllabus is the only document that is legally binding the depth must be specified in the syllabus.
2. The full range of documentation must be available before implementation of the syllabi and include teacher guidelines, practical coursework guidelines, sample examination papers, sample marking schemes. This the standard practice experienced by science teachers who teach syllabi which are recognised at international level, e.g. the International Baccalaureate and the syllabi published by the OCR (Oxford, Cambridge and Royal Society of Arts) in the UK for GCSE and A- level subjects.
3. We recommend that an external, independent evaluation of Junior Cycle Framework and the Leaving Certificate subjects that have recently been implemented using the same template as was used at Junior Cycle. This external evaluation should be carried out by personnel from outside Ireland and by experts in curriculum design.

It is our earnest wish that the above recommendations are implemented as quickly as possible in a collaborative and diligent way that is respectful of the views of teachers and of other stakeholders in the world of education.

The ISTA wishes to once again express its sincere thanks to the members of the Joint Committee on Education, Further and Higher Education, Research, Innovation and Science for welcoming the ISTA to today's round table discussion.

Opening *Statement from Humphrey Jones, Vice Chairperson, Irish Science Teachers' Association*

March 22nd 2023