Irish
Science
Teachers'
Association

Eolaithe
na hÉireann

Faha,
Killarney
Co. Kerry

6/10/'21
Email: istahonchairman@gmail.com

Your Ref: JCES-I-2021-[582]

Ms Tara Kelly,
Joint Committee on Education,
Further and Higher Education,
Research, Innovation and Science,
Leinster House,
Dublin 2

Dear Ms Kelly,
Thank you for the invitation to the Irish Science Teachers' Association to make a brief, written submission as part of the Committee's examination of Leaving Certificate reform. I note from your letter that this submission must be no more than five A4 pages long and we have tried to be as concise as possible in this submission.

The ISTA is the professional organisation representing teachers of Leaving Certificate Physics, Chemistry and Biology in Ireland. It was founded in 1961 and in excess of 1200 teachers from all sectors of education are members of ISTA. The ISTA maintains close links with other science teachers' associations at international level and is an active member of the International Council of Associations for Science Education (ICASE). The ISTA functions as a body dedicated to the professional development of its members and the advancement of science teaching. The ISTA is committed to high standards of science education in Ireland that are comparable to those found at international level.

In this submission we focus on area 6 (International Evidence and Best Practice) of Leaving Certificate reform. We hope that this submission will be of assistance to your committee in its deliberations on Leaving Certificate Reform – particularly in regard to the reform of the current Leaving Certificate Physics, Chemistry and Biology syllabi. .

Yours sincerely,

Sean Finn (Hon Chairman)

Humphrey Jones (Hon Vice Chairman)

Submission to Joint Committee on Education, Further and Higher Education, Research, Innovation and Science.

Executive Summary

This submission focuses on reform of the current Leaving Certificate Physics, Chemistry and Biology syllabi (specifications). Whilst the focus is on these three science subjects, the submission is relevant to all Leaving Certificate subjects since the same flawed template of syllabus design is being used for the reform of all Leaving Certificate subjects.

The Bologna Process (1999) and the European Qualifications framework for Lifelong learning (2008) has placed the focus on the use of learning outcomes in teaching, learning and assessment in our classrooms. The concept of learning outcomes has brought great clarity to curricula at international level but a major problem has arisen in Ireland. This problem has been caused by the NCCA using a "learning outcomes **only"** approach when designing syllabi (specifications). The term "specification" is a misnomer. Whilst the term has been borrowed from the UK, the syllabi published by NCCA do not contain the same detail of the specifications published in the UK. This problem has resulted in vague syllabi being published by the NCCA with teachers and students 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*. 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 vague learning outcomes, increased stress on students and teachers and the unsuitability of the syllabus template for the Leaving Certificate. Of the 762 teachers who completed the survey, 85% of them stated that they did not wish this "learning outcomes only" template to be used for designing Leaving Certificate subjects. The NCCA has never justified the "learning outcomes only" approach and a freedom of information request to NCCA has shown that there is no justification for using this approach.

The problems highlighted by the ISTA in 2019 were predicted in the Hyland Report (2014). In this report, Professor Áine Hyland, Emeritus Professor of Education, UCC, pointed out that the syllabi (specifications) being published by NCCA were not in keeping with international best practice as they lacked the details of similar syllabi being taught at international level.

The vague "learning outcomes only" template was used in the new Agricultural Science syllabus introduced in 2019. This "specification" consists of only nine pages of learning outcomes which teachers and students struggled to interpret. Once again, all the problems encountered by the teachers of Agricultural Science were predicted in the Hyland Report.

The Leaving Certificate syllabi currently being taught are in keeping with international standard as they contain details of depth of treatment, suggestions for teaching activities, Science in Society topics and clearly defined lists of mandatory student experiments. However, new specifications currently being designed for Leaving Certificate Physics, Chemistry and Biology are using the same template as was used for Agricultural Science. This flawed syllabus design will cause the same problems for Physics, Chemistry and Biology as have been caused for Agricultural Science.

This submission makes five key recommendations that are necessary in order to ensure that the proposed new Leaving Certificate Physics, Chemistry and Biology specifications are in keeping with international best practice.

6. International Evidence and Best Practice

Introduction

As a professional organisation whose members give of their time freely to ensure high standards of science education in Ireland, We welcome the opportunity to assist in the revision of the current Leaving Certificate Physics, Chemistry and Biology syllabi. We are fully supportive of the need to revise these subjects and are enthusiastic supporters of teaching within a learning outcome framework in which details and depth of treatment associated with each learning outcome are provided. We love teaching science and we are passionate about the subjects Physics, Chemistry and Biology. However, we do not wish to see the current excellent Leaving Certificate Biology, Chemistry and Physics subjects being destroyed and replaced with inferior and vague specifications that are not of international standard. The reform of the current Leaving Certificate Physics, Chemistry and Biology syllabi is being carried out without any reference to the lessons learned from the introduction of the new Junior Cycle science syllabus (specification) in 2016 or the Leaving Certificate Agricultural Science specification in 2019.

A survey was carried out in 2019 by the ISTA to enable science teachers to give feedback on their experience of teaching this new Junior Cycle science curriculum. A total of 762 teachers responded to the survey and the findings published in the report *Listening to the Voice of Science Teachers* (ISTA, 2019).

Among the problem reported by science teachers were:

- **Vagueness of learning outcomes** - teachers commented on the need for depth of treatment because the specified "learning outcomes" are open to wide interpretation and were unclear on what exact content teachers were expected to teach. One teacher commented that the specification (syllabus) template was like an "Ikea style flatpack with no accompanying instructions".

- **Unsuitability of syllabus template for a high stakes examination** - teachers strongly expressed their concern that a similar template might be used at Leaving Certificate level, due to the high-stakes nature of the Leaving Certificate examination. Some teachers who teach the International Baccalaureate exam pointed out how poorly the NCCA template compared with syllabi at international level.

- **Increased stress on students and teachers** - teachers emphasised that vague syllabi at Leaving Certificate would lead to increased stress being placed on students and teachers due to the fact that teachers would be unsure of what exactly was on the curriculum and hence would have enormous problems adequately preparing their students for the Leaving Certificate examination.

The ISTA expressed its concern to the NCCA in 2014 and requested that depth of treatment and range of subject knowledge be integrated into the draft syllabi (as is the case with the syllabi currently being taught)**.** The views of the ISTA were ignored by the NCCA which stated in a written reply that "We don't intend to include 'depth of treatment' and/or 'range of subject knowledge' in the new specifications for the sciences or for other subjects in senior cycle."

As no progress was made with the NCCA, it was decided by ISTA Council to commission Professor Áine Hyland , Professor Emeritus of Education, UCC, who is an international expert in the area of curriculum design and assessment. In addition, Professor Hyland is an expert in the area of learning outcomes as it was she who introduced learning outcomes into Ireland in the early 2000s.

Professor Hyland was asked by the ISTA to address two fundamental research questions about the 2014 draft Leaving Certificate specifications:

- What is international best practice in the drafting of syllabi for second-level curricula?
- Is the current reform of Leaving Cert syllabi in Ireland in line with international best practice?

In order to address the above research questions, Professor Hyland examined a wide range of science syllabi for a similar age group as the Leaving Certificate and a centralised (i.e. not school-based) mode of assessment (similar to the Leaving Certificate) at international level. From the data gathered, she identified the characteristics of international best practice in syllabus design. The full report is available at https://www.ista.ie/the-hyland-report-2/

The three main recommendations of the Hyland Report may be summarised as follows:

1. Syllabi need to be brought up to international standard. Professor Hyland points out very clearly that "more detailed information about the depth of treatment of subjects and the requirements for examination must be provided at national level in Ireland to bring the syllabi into line with international good practice." Professor Hyland also recommends that the depth of treatment of the draft Leaving Certificate biology, chemistry and physics syllabi should at least be brought up to the standard of the current syllabi being taught in schools at present.

2. **Full range of documentation available before implementation of the syllabi**. Professor Hyland recommends that "the full range of syllabus documentation (including teachers' notes, examination specifications etc.) should be officially published at the same time as the syllabus itself, under the logo of the DES as has been the case in the past. This elaborated documentation should be available well before the syllabus is due to be implemented, to enable teachers to become familiar with the new material and to undergo appropriate professional development and up-skilling". In the case of the Junior Cycle science curriculum, the SEC sample examination paper was not made available until year 3 of the programme. In the case of the Agricultural Science specification, the sample examination paper was not made available until students were in their final year of the programme.

3. Depth of treatment should be embedded within the syllabi. Professor Hyland points out the importance of having depth of treatment embedded within syllabi developed by NCCA: "From 1989 to date, the advice provided by the NCCA to the Minister has included the level of detail that teachers expect and need to enable them to prepare their students for the Leaving Certificate public examinations. That level of detail has also been used and will continue to be required by the SEC to enable them to set and mark the Leaving Certificate examination papers. It is the considered opinion of this researcher, that the issue of depth of treatment and clarity of examination specifications will become an issue for all Leaving Certificate subjects as the revision of Leaving Certificate syllabi proceeds. It is almost inevitable that the concerns raised by ISTA will be echoed by other subject teachers and associations as well as by third level representatives if the matter is not addressed now."

In keeping with international best practice, syllabi at international level are very detailed documents, e.g. International Baccalaureate (IB) in biology (169 pages), IB Chemistry (194 pages), IB Physics (158 pages), Scotland Advanced Higher Biology (129 pages) and Scotland Advanced Higher Chemistry (129 pages).

The Irish Agricultural Science Teachers' Association has encountered major problems in trying to interpret vague learning outcomes in the new Agricultural Science specification. The

specification consists of only nine pages of learning outcomes and there here are flaws in the writing of the learning outcomes on seven of these pages.
All of the problems being encountered in the Agricultural Science specification were predicted in the Hyland Report in 2014. Professor Hyland is a giant on the international stage of curriculum development. We cannot understand why the recommendations of this report have not been implemented by the Department of Education. A freedom of information request to NCCA asking for all documentation on which they based the current template of syllabus design has shown that there is no evidence to justify the NCCA policy to publish vague "learning outcomes only" syllabi.

Recommendation 1: To ensure that Leaving Certificate syllabi are in keeping with international best practice, the above three recommendations of the Hyland Report should be implemented by the Department of Education.

2. Science in Society. In 2000 the introduction of Science in Society topics to the Physics, Chemistry and Biology syllabi currently being taught was in keeping with international trends in science education and was done at the specific request of the science inspectorate of the Department of Education and Skills. Unfortunately, in the current draft specifications (syllabi) a vast array of topics showing the relationship between science and society has been deleted. For example, in the current Leaving Certificate chemistry syllabus, the contributions of Marie Curie and Dorothy Hodgkins are highlighted in the Science and Society column. Both of these scientists have been completely removed from the proposed new chemistry specification. In fact, there is not a single woman scientist mentioned anywhere in the new chemistry specification. This is also the case in the physics and biology specifications. At a time when the public understanding of science is paramount, the removal of the Science in Society pillar makes no sense and goes against all international trends in design of science curricula as well as undermining efforts to encourage more females into the STEM subjects.

Recommendation 2: To ensure that the standard of science syllabi are in keeping with international best practice, a Science in Society column should be introduced into the template being used to design the new Physics, Chemistry and Biology specifications. The Science in Society column should reflect the contributions of both women and men to advances in scientific knowledge and understanding that affect our everyday lives.

3. Mandatory student experiments. "High tech" industries such as those in the areas of pharmachemicals, electronics and food industry place great emphasis on practical laboratory skills. The Leaving Certificate Physics, Chemistry and Biology syllabi currently being taught have clear lists of mandatory student experiments to ensure that students will acquire fundamental practical skills. In the draft specifications, experiments are embedded within learning outcomes, are open to interpretation and we are unclear on what exactly students are expected to do.

Recommendation 3: In keeping with international best practice, she current drafts of the Leaving Certificate Physics, Chemistry and Biology specifications should have clearly stated lists of mandatory student experiments.

4. Timescale for finalising specifications. Our representatives on the Physics, Chemistry and Biology subject development groups agree that there is still a huge amount of work to be done on the draft specifications. All three subject development groups are very much behind schedule in our work due to the COVID-19 pandemic. Full-day meetings have been replaced with online meetings lasting only two hours. In view of the fact that meetings only lasted 2 hours, work could not proceed at the same rate as the original timeframe. In addition, due to the allocation of NCCA personnel to contact tracing duties, some of the two-hour meetings were cancelled.

The Leaving Certificate Physics, Chemistry and Biology specifications as they currently stand are in an unfinished state. As practising science teachers, we do not wish to struggle to teach these "half baked" syllabi.

The ISTA is very concerned that the perception by students that science subjects are difficult will be exacerbated by vague unclear specifications that will add greatly add to this perception. This will eventually translate into lower numbers choosing science subjects for Leaving Certificate.

Recommendation 4: In view of the time lost due to the COVID-19 pandemic, extra time needs to be allowed for the subject development groups to complete their work before the specifications are released for consultation. In addition, we request that the NCCA Subject Development Groups meet to discuss feedback received in the consultation process in order to implement any changes that may be necessary in light of the feedback received. As mentioned in Recommendation 1 above, the full range of documentation (sample examination paper, teachers' notes, etc) should be available well before the syllabus is due to be implemented, to enable teachers to become familiar with the new material and to undergo appropriate professional development

Recommendation 5: A quality assurance system should be set up to ensure that Leaving Certificate Reform results in the development by NCCA of subject specifications (syllabi) that are of international standard. This quality assurance system should be overseen by external, independent personnel who are internationally recognised as experts in curriculum development and design. The quality assurance system should also ensure that when draft specifications are sent out to stakeholders for consultation, the feedback received from stakeholders should be analysed by experts who are independent from NCCA.

Conclusion

We do not wish to see the excellent Leaving Certificate Biology, Chemistry and Physics syllabi currently being taught in our schools being destroyed and replaced with inferior and vague "specifications" that are not of international standard. We have exhausted every avenue by writing to the NCCA and meeting with NCCA but have met with a blank wall. There does not appear to be any quality assurance system in operation to ensure that the curricula being designed by NCCA are in keeping with international best practice. This Oireachtas committee is our only hope of saving the subjects of Physics, Chemistry and Biology from being severely damaged.

The ISTA wishes to express its sincere thanks to the members of the Joint Committee on Education, Further and Higher Education, Research, Innovation and Science for taking the time to study this submission.