

Title	150 years of science education in Irish secondary schools
Authors	Hyland, Áine
Publication date	2025
Original Citation	Hyland, Á. (2025) '150 years of science education in Irish secondary schools' [forthcoming], ICASE International Bulletin for Science Education.
Type of publication	Article (peer-reviewed)
Rights	© 2025, the Author.
Download date	2026-08-09 15:09:07
Item downloaded from	https://hdl.handle.net/10468/17788

150 years of Science Education in Irish Secondary Schools

Paper submitted by Áine Hyland for publication in the *ICASE International Bulletin for Science Education*, June 2025.

Abstract: This paper provides an overview of science education in Irish secondary schools over the past 150 years. It describes how the science curriculum developed over the decades as scientific discoveries were made. Until the middle of the 20th century the secondary school curriculum was biased in favour of the humanities but since the 1960s, science and technology have played a central role in Irish secondary education.

Ireland and the Irish Education System

Ireland is an island country situated in the Atlantic Ocean, west of Great Britain. It is a politically divided island, the six counties of Northern Ireland are part of Great Britain and the remaining 26 counties are a republic and are referred to as Ireland (Éire in the Irish language).

The population of Ireland is 5.3 million people. This is the highest figure since census figures were first published in 1861 and represents a significant increase in the past 20 years. Inward migration in recent years accounted for much of this increaseⁱ.

The education system in Ireland consists of an eight-year primary cycle (4 – 12-year-olds) followed by a six-year post-primary cycle (12 – 18-year-olds). The post primary cycle consists of a three-year junior cycle (lower secondary) followed by a two or three-year senior cycle (upper secondary). There are about 3,000 primary and 700 post-primary schools in the country, with enrolments respectively of about 500,000 and 350,000 pupilsⁱⁱ.

The first year of senior cycle consists of an optional Transition Year (TY). TY provides an opportunity for students to experience a wide range of learning experiences including work experience over the course of a year that is free from formal state examinations. During the final two years of senior cycle, students take one of two senior cycle programmes - leading to a state examination. The majority of students (almost 94%) follow the (established) Leaving Certificate programme and the remainder follow the Applied Leaving Certificate programme. More than 30 subjects are available in senior cycle and students are required to take at least five subjects one of which must be Irish language and Literatureⁱⁱⁱ. On average, students take seven subjects for the Leaving Certificate. Most subjects are offered at two levels, ordinary and higher. In addition, Irish and mathematics are available at foundation level^{iv}.

The school curriculum is set by the Minister for Education who is advised by the National Council for Curriculum and Assessment. State examinations are administered by the State Examinations Commission which is an agency of the Department of Education. The selection of textbooks and classroom resources to support the implementation of the curriculum is made by schools. Continuing Professional Development for teachers is provided by a state body called Oide^v.

The History of Science Education in Ireland:

Science education has had a chequered history in Ireland over the past 125 years. Before Ireland became an independent state in 1922, elementary science was a mandatory subject in Irish primary schools. After Independence, elementary science was removed from the primary curriculum, and the emphasis for the following half-century was on reviving the Irish language, history, music and culture^{vi}. It was not until 1971 that science again re-appeared on the primary curriculum as part of the curricular group, Social, Environmental and Science Education. However, the science aspect of the curriculum was not well implemented because of a lack of resources and lack of expertise among teachers. This was reflected in the relatively poor performance of Irish primary students in successive OECD comparative studies in the 1980s and 1990s – the International Assessment of Educational Progress Report (IAEP) in 1988 and the Trends in International Mathematics and Science Study (TIMSS) in 1997^{vii}. The primary science curriculum has recently been revised and a new science curriculum will come into effect shortly^{viii}.

The Science Curriculum in Secondary Schools 1878 - 1921

At secondary school level, Experimental Science was introduced in 1878 as one of a group of examination subjects by the then newly established Intermediate Education Board. During the following 43 years, grants were paid to secondary schools on the basis of the results of their students at examinations^{ix}. Until 1922, Experimental Science was examined at three grade levels – Junior Grade, Middle Grade and Senior Grade. Students could choose either Physics, Chemistry, Botany, Hygiene or Domestic Economy – not more than two of which could be chosen for examination purposes. Female students could also study Domestic Economy. The syllabus for each of the science subjects was extensive and surprisingly modern. For example, the Physics syllabus in the early 20th century included Mechanics, Light, Magnetism and Electricity. The Chemistry syllabus included the Atomic Theory; Molecular weights; Atomic weights; Formula for Water; Quantitative Relations between Acids and Alkalis; Common Metals and their more Important Derivatives^x.

However, at that time, fewer than 10% of the relevant age group attended secondary schools and only a small proportion of those studied a science subject.

The Science Curriculum in Secondary Schools 1922 – 1960s

After Independence in 1921, payment by results was abolished and the structure of the education system changed. The Junior, Middle and Senior grade examinations were replaced by the Intermediate and Leaving certificate examinations, and the programme of examinations which continued to dominate the work of the secondary schools was set nationally by the secondary inspectorate of the newly formed Department of Education^{xi}.

As in primary schools, there was significant emphasis in secondary schools after Independence on the nationalist revival, and Irish became a compulsory subject for all secondary school students in 1926. The classical languages - Greek and Latin - were heavily emphasized, especially in boys' schools. Some subjects were more valuable than others in terms of the total marks allocated at Leaving Certificate level. This was significant, as university scholarships and selection for teacher training and civil service posts used the Leaving Certificate raw scores to draw up an Order of Merit list. Higher Irish, English and

Mathematics were worth 600 marks (Elementary Mathematics was worth only 300 marks); Latin, Greek, History, Geography as well as Domestic Science were worth 400 marks; French, German, Italian, and Spanish as well as Science subjects, Commerce and Music were worth 300 Marks; and Drawing was worth only 200 marks. Almost all subjects were examined at either pass or honours level. The standard for passing a subject was 40% on the pass paper are 30% on the honours paper; for an honours grade 50% was required^{xii}.

By the middle of the 20th century, students could take a two-year course at Leaving Certificate level in any one or more of the following subjects – Physics; Chemistry; Physics and Chemistry; Agricultural Science: Botany; Physiology and Hygiene; General Science and Domestic Science. Students who chose the combined subject, Physics and Chemistry could not take either of the separate subjects Physics or Chemistry. And students who chose the subject General Science could not take any of the other science subjects^{xiii}.

The Intermediate and Leaving Certificate science syllabi were published in the Department of Education's annual *Rules and Programme for Secondary Schools* and were content-heavy. For example the syllabus for Pass Leaving Certificate Chemistry in 1965 included^{xiv}:- the properties of gases, liquids and solids; atomic theory; structure of simple molecules; the structure and valence of elements as exemplified by the first 20 elements of the Periodic Table; The Kinetic Theory of the Gas Laws; Determination of equivalent, atomic and molecular weights; the study of a long list of elements and compounds ; study of the chemistry of methane, ethylene, acetylene, ethyl alcohol; acetaldehyde; acetic acid' benzene and nitrobenzene; heats of formation and heats of reaction; modern concepts of acid-base reactions, oxidation-reduction processes. And for Honours Leaving Cert, in addition to the Pass syllabus, students had to study:- Concepts of energy levels; the shape of simple symmetrical molecules; the Periodic Table in relation to Atomic structure; study of the chemistry of a range of chemicals; First Law of Thermodynamics; the Law of Mass Action and electrolytic solutions; Oxidation and reduction; examples of reaction mechanisms (e.g. chlorine and methane); radioactive isotopes and their uses; identification of the ions of the chief salts.

The Report of the Council of Education on the Curriculum of Secondary Schools:

A Council of Education, comprising Church representatives, school management authorities and academics was set up by the government in April 1950. Its report on the secondary school curriculum, published in 1962, “approved generally of the existing regulations which provide the framework for the junior and senior cycle curricula” stating that “the ultimate purpose of secondary schools in Ireland is to prepare their pupils to be God fearing and responsible citizens”. It affirmed that liberal or general education (i.e. an all-round formation of the faculties) is “the immediate object of the secondary school”. The report saw no need to reform the curriculum at either junior or senior cycle. At a time when free second level education had become the norm in other European countries, the report dismissed the suggestion that such a reform should be implemented in Ireland, describing free secondary education for all as “utopian”^{xv}.

The Council of Education was not sympathetic to the growing world movement which gave greater emphasis to science in second level curricula. It did not support the inclusion of science in junior cycle as a mandatory subject, nor did it support the notion of a practical approach to science teaching, stating^{xvi}:

the aim of science education is cultural rather than practical: the purpose is not to impart specialized knowledge, nor to give manipulative skill, but rather to provide that broad knowledge of the laws of nature which will leave the pupil with an intelligent general understanding of the physical universe in which he lives....

The report set out the purpose of science teaching at junior and senior cycles as follows:

The purpose of science studies in the junior secondary curriculum is to give a basic knowledge of science and of what it has achieved in the history of mankind and to make the young person realize the importance of scientific research.... (At senior cycle) the purpose is to lay solid foundations for future specialisation in pure or applied science and for those who do not propose to undertake such specialisation, to extend their general education.

Fortunately, the report of the Council of Education did not influence Irish education in the subsequent decades as its recommendations were regarded as unduly conservative at a time when traditional attitudes to education were beginning to change. By the early 1960s it was clear that the Irish government's policy of self-sufficiency and agrarianism which had been adopted since Independence had failed. A national *Programme for Economic Development* published in 1958^{xvii} refocused Ireland's economic policy on industrial development supported by foreign direct investment. Such an economy would require a well-educated workforce and science subjects would play an important part in the revised secondary school curriculum.

The Investment in Education Report, 1965:

In 1965, the recommendations of the report of the Council of Education were challenged by the *Investment in Education* report^{xviii}. This report, supported and partly funded by the Organisation for Economic Co-Operation and Development (OECD) highlighted many shortcomings in the Irish education system. Unlike other European countries which had introduced free second level education after the Second World War, secondary schools in Ireland were not free and access was limited to those who could afford to pay school fees. By the mid-1960s there were only about 12,000 students taking the Leaving Cert., i.e. fewer than 20% of the relevant age cohort. Almost half of the population completed their education without any second level qualification and the number of students (especially girls) who studied even one science subject was very low. The report suggested that the second level curriculum was excessively academic in content and method. In the context of a country which was hoping to develop its international industrial and business focus, the findings of the *Investment in Education* report indicated that the education system required significant reform.

Free Second Level Education 1967

Following the publication of the *Investment in Education* report, the government introduced free second level education in Ireland in 1967. Within little more than a decade, the numbers sitting the Leaving Cert. increased more than threefold to almost 40,000 students – more than 60% of the relevant age group^{xix}. The Leaving Certificate curriculum was expanded by the addition of the following subjects:– Biology; Engineering Workshop Theory and Practice; Technical Drawing; Building Construction; Agricultural Economics; Home Economics (Scientific and Social); and the subject Commerce was replaced by four separate subjects – Accountancy; Business Organisation; Economics and Economic History. A Transition Year option was introduced in 1973 - a one-year non-exam focused programme at the beginning of senior cycle – it was provided on a pilot basis in only a small number of schools. The new Leaving Certificate programme in Biology included zoology, genetics, ecology, and evolution as well as botany and physiology^{xx}.

White Paper on Educational Development 1980

A *White Paper on Educational Development* which was issued more than a decade later by Minister for Education John Wilson was far-seeing^{xxi}. It highlighted the importance of scientific and technological education and observed that “the most significant development in the eighties may be spectacular improvements in methods of information processing and communication” adding: “These will have a bearing not only on what is learned, but on how it is learned”. It stated that young people who would leave school in the eighties would enter “a world of work strongly influenced by the computer”. It recommended “both in their own interests and in the interest of society generally, that they have the opportunity while at schools of becoming familiar with the basic concepts and techniques of computer operations”. A Computer Studies module was introduced into senior cycle classes in the school-year 1980/81 and it was proposed to introduce course in Computer Studies into the Intermediate and Leaving Certificate curriculum within a short period.

The White Paper also recognised the importance of experimental work in science subjects and stated that “the fact that experimental work, which is such a distinctive part of the scientific” was not specifically tested in the Certificate Examinations “militates against (science subjects) in the allocation of time and facilities in the schools”. The White Paper committed to introducing “a scheme for giving credit for experimental work on a pilot basis in Physics in the Leaving Certificate Examination in 1983”. However, the political landscape changed in the early 1980s and neither of these two proposed curricular innovations were implemented.

Curriculum and Examinations Board 1984 - 1987

In 1984, a Curriculum and Examinations Board (CEB) was set up by the Fine Gael Minister for Education, Gemma Hussey, to advise on the reform of curriculum at primary and second level. The board included academics, representatives of school management bodies, representatives of industry, parents and teachers. It was intended

that the CEB would be a statutory body and that it would take over responsibility for curriculum and assessment from the Department of Education inspectorate and would also have executive responsibility for the examinations system. The CEB published a number of discussion papers and reports during its three years in office. These included recommendations for significant curriculum change, especially at junior cycle. Among the documents issued by the CEB was a discussion *Paper on Science and Technology and the Post-Primary Curriculum* (March 1987)^{xxii}. However, the CEB was disbanded before a final report and recommendations on Science in the second level curriculum could be issued.

National Council for Curriculum and Assessment 1989

In 1988, following the appointment of Fianna Fáil Minister, Mary O'Rourke, the CEB was disbanded and a National Council for Curriculum and Assessment (NCCA), initially an advisory body without executive functions, was set up. It was subsequently established on a statutory basis in 2001 with a remit "to advise the Minister on matters relating to (a) the curriculum for early childhood education, primary and post-primary schools and (b) the assessment procedures employed in schools and examinations on subjects which are part of the curriculum"^{xxiii}.

The Council of the NCCA is composed of representatives of various education and industry/ business partners. Work on individual syllabi is overseen by subject development groups (referred to in the past as syllabus or course committees). The composition of these subject-specific groups has varied from time to time since the 1980s. Currently each group includes representatives of the teacher unions (ASTI and TUI); management bodies (JMB and IVEA); the university sector (IUA); employers (IBEC); the State Examinations Commission; the inspectorate of the Department of Education; the relevant subject associations; and other members with relevant expertise^{xxiv}.

Junior Certificate Examination 1989

A new Junior Certificate examination to replace the Intermediate Certificate and Group Certificate examinations was introduced in 1989. This unified system at junior cycle aimed to remove barriers to social equity within the education sector^{xxv}. The introduction of a new unified system provided an opportunity to undertake a major review of the entire junior cycle curriculum. For the first time, the junior and senior cycle curriculum would be informed by an overarching philosophy and a new format for syllabus design was introduced. This format included a clear statement of aims and objectives for each subject; a description of the syllabus structure and content; a detailed set of assessment objectives and ancillary material including teacher notes, guidelines for assessment, sample questions, assignments, illustrative material – all of which would be regularly updated^{xxvi}.

The State Examinations Commission (SEC) 2003.

For a number of years after the setting up of the NCCA, the inspectorate of the Department of Education continued to set and administer the public examinations and it was not until March 2003 that a state agency, the State Examinations Commission (SEC) which reported to the Department of Education, was established by statutory order^{xxvii}. The SEC has responsibility for the development, assessment, accreditation and certification of the second level examinations of the Irish State - the Junior Cycle and the Leaving Certificates. The fact that two separate bodies have responsibility for curriculum and for state examinations has contributed at times to a lack of alignment between curriculum and examinations.

A New Design Framework for Science Curriculum 2000

Throughout the late 1980s and early 1990s the NCAA engaged with the education partners through the members of the council and its course committees and subject development groups, as well as by public consultation when reviewing and reforming curriculum and syllabi. A new design framework for second level syllabi was agreed and individual subject syllabi were revised from the mid-1990s onwards. Revised syllabi for Leaving Certificate biology, chemistry, and physics were implemented between 2000 and 2002 and were first examined in 2004 /2006. These syllabi were published in booklets of between 45 and 75 pages, accompanied by *Guidelines for Teachers*, comprising about 100 pages. Both the syllabi and the *Guidelines for Teachers* were approved by the Minister for Education and were issued under the logo of the Department of Education.

The format and layout of each syllabus was consistent and clear with a couple of pages setting out the policy context, an introduction outlining the aims and structure of the syllabus together with a paragraph on assessment. Each syllabus identified a number of key topics. The number varied for different subjects but was usually between 5 and 15. Each syllabus contained a statement of objectives distinguishing between ordinary and higher levels under the following headings: knowledge; understanding; skills; competences and attitudes. In the case of Leaving Certificate science subjects, the syllabus was set out in 4 columns:- content; depth of treatment; activities; and social and applied aspects. The syllabus and guidelines were available in hard copy and online. The following page from the Leaving Certificate Chemistry syllabus is an example of the format and layout used^{xxviii}:

7. ORGANIC CHEMISTRY (CONTINUED)			
Content	Depth of Treatment	Activities	Social and Applied Aspects
7.2 Planar Carbon (continued)	Ketones: structure and nomenclature up to C-4.		
	Physical properties [physical state, solubility (qualitative only) in water and in non-polar solvents].	Solubility of propanone in (i) cyclohexane and (ii) water.	Propanone as a solvent (e.g. in nail varnish remover).
	Carboxylic acids: polar double bond. Structure and nomenclature up to C-4.	Solubility of ethanoic acid in (i) cyclohexane and (ii) water.	Methanoic acid in nettles and ants; ethanoic acid in vinegar. Use of ethanoic acid in the manufacture of cellulose acetate (structure of cellulose acetate not required). Use of propanoic acid and benzoic acid and their salts as food preservatives (structure of benzoic acid not required).

The revised physics, chemistry and biology syllabi, introduced between 2000 and 2002 were well received by teachers. They played a part in halting the decline in the numbers of students taking chemistry and biology in senior cycle. At the most recent Leaving Certificate examinations in 2004, 33,200 students (60% of the total number sitting Leaving Certificate) sat Biology; 9,400 (17%) sat Chemistry and 7,300 (13%) sat Physics^{xxix}.

A New Syllabus Design 2010

The print on the revised subject syllabi was hardly dry when the NCAA began to review senior cycle education again. In 2003 the NCAA issued a consultative document *Directions for Development* and began extensive consultations with education stakeholders and the public on the future direction of senior cycle^{xxx}. The NCAA's initial proposals were rejected by the then Minister for Education, and it was not until 2009 that the NCAA issued the outcome of its deliberations in a document entitled *Towards Learning: an overview of senior cycle education*^{xxxii}. Influenced by the Lisbon strategy and the National Skills Strategy (2007)^{xxxii}, the approach to senior cycle curriculum emphasised a skills approach to curriculum development. The five key skills of information processing, being personally effective, communicating; critical and creative thinking; and working with others, were to be central to the development of the senior cycle curriculum.

Following the publication of the document *Towards Learning*, the NCAA began to develop and revise individual Leaving Certificate subject syllabi. However, difficulties arose because of the design of the template for the revised syllabi proposed by the NCAA, especially in relation to the three science subjects, Biology, Chemistry and Physics. The NCAA had introduced a new template for Junior Cycle subjects which was challenging for students and teachers because of its vagueness and lack of clarity. No details were provided about the depth of treatment that would be expected nor were any details provided about how the

learning outcomes would be assessed. The template, consisting only of themes and learning outcomes, was to be used for the revised Leaving Cert subjects. When concerns about the template were raised by the Irish Science Teachers Association (ISTA) the NCCA insisted that the design was in line with “international best practice”.

The Design of Leaving Certificate science syllabi in Ireland: an international comparison

In 2014 this author was asked by the ISTA to carry out research on the design of science curriculum in other jurisdictions with a view to identifying “international best practice”^{xxxiii}. The research focused on the design of externally assessed senior cycle curriculum and syllabi and the jurisdictions chosen for comparison purposes were Scotland and the state of Victoria in Australia. Curriculum and syllabus design in jurisdictions where student assessment was school-based and carried out by the students’ own teachers were not regarded as relevant comparators. The design of syllabi for the International Baccalaureate Diploma was also analysed. A paper published by this author in 2014 showed that in jurisdictions in which senior cycle curriculum was set and assessed externally, considerable detail was provided about each individual syllabus and its assessment. The research failed to find even one example of **externally assessed** syllabi where the skeletal syllabus design proposed by the NCCA was used. In her report, the author cautioned against using the Junior Cycle template for new or revised Leaving Certificate science subjects.

New and Revised Leaving Cert syllabi 2017 – 2022

Despite the misgivings that had been expressed, the contested template was used by the NCCA in subsequent years for new and revised Leaving Certificate subjects. It was used for the revised syllabus for Agricultural Science which was introduced in 2017 and for the syllabi for new subjects such as Computer Science and Physical Education. Students and teachers expressed misgivings about the vagueness of these syllabi and their lack of clarity. When the subjects were examined for the first time, concerns were expressed about the lack of alignment between the NCCA specifications and the examinations set by the State Examinations Commission (SEC).

Various journal articles highlighted teacher concerns about the design of junior and senior cycle syllabi. In Nov. 2019, in an article entitled “*Moving from Junior Cycle Science to the Leaving Certificate Sciences*” Declan Kennedy articulated these concerns^{xxxiv}. In February 2020, a special ISTA conference “*From JC science to LC Sciences: Issue and Challenges*” was held. The November 2021 issue of *Science* included a submission from ISTA to the Joint Oireachtas Committee on Education summarizing the shortcomings of the approach being taken by the NCCA to senior cycle reform. And various articles in the May/November edition 2023 discussed the implications of the revised Agricultural Science syllabus and the new Computer Science syllabus for the new Leaving Cert Science subjects^{xxxv}.

A number of subject associations, including the Irish Agricultural Science Teachers Association (IASTA) and An Gréasán (the association for teachers of Irish) also published reports highlighting the issues that they had encountered with the new design. In 2022, the Association of Secondary Teachers in Ireland (ASTI) produced a report entitled “*Teachers Experience of the Implementation of the Framework for Junior Cycle*”^{xxxvi}. In summary, the report concluded that “it would be an understatement to say that there is a profound and

universal concern among teachers about the capacity of the junior cycle subject specifications to prepare students for the senior cycle curriculum” adding

Learning outcomes remain problematic. They are too broad, too vague and are lacking in guidance to the teacher on what students are expected to be able to do in order to show that they have achieved each learning outcome.

The Joint Oireachtas Committee on Education in two different reports (“*Learning for Life*” in 2022 and “*The Future of STEM in Irish Education*” in 2023)^{xxxvii} drew attention to the problems associated with the template being used by the NCCA. The committee advised that the Department of Education should publish revised specifications for Biology, Chemistry and Physics at senior cycle before the end of 2023 stating that “A key priority should be that the revised syllabus for each subject is far more detailed with comprehensive instructions for teachers”. It recommended that

The National Council for Curriculum and Assessment reviews the proposed design of the new specifications to ensure that teachers are properly supported and students are taught to the highest professional standards.

In the meantime, no revision or updating of the Leaving Certificate Physics, Chemistry or Biology syllabi had taken place for almost twenty years and there was widespread agreement that revision and updating was overdue.

Proposals for Senior Cycle Reform 2022 and 2023

In March 2022 Minister for Education Norma Foley set out her proposals for senior cycle reform in a document “*Equity and Excellence in Education*.”^{xxxviii} She indicated that the emphasis on and the stress caused by the Leaving Certificate terminal examination would be alleviated and reduced by introducing assessment other than a terminal examination in all subjects. New and revised subject specifications would be introduced on a pilot and gradual basis. In the case of English and Irish she proposed that Paper One would be examined at the end of Fifth Year and Paper Two at the end of Sixth Year.

When it became clear that the proposals in relation to English and Irish could not be implemented (since they did not envisage any revision of the subject syllabi), the Minister issued revised proposals in September 2023^{xxxix}. She stated that from 2025 students “would benefit” from an earlier rollout of nine new and revised subjects including Biology, Chemistry and Physics – the new syllabi to be examined for the first time in 2027. She stated that each subject would incorporate externally assessed components worth not less than 40% of the overall marks (to be examined by the State Examinations Commission) that would not be a traditional written examination.

NCCA Publications on Senior Cycle Reform 2022 and 2023

Various papers on senior cycle reform were published on the NCCA website during 2022 and 2023. These included a paper published in July 2023 entitled *Key Competencies in Senior Cycle Design*^{xl} – which set out the key competencies as Managing Learning and Self; Thinking and Solving Problems; Being Creative; Communicating; Working with Others; Participating in Society; and Cultivating Wellbeing. Literacies and Numeracy were included as an overarching competency. This “competencies framework” would inform new and

revised Leaving Cert syllabi and would supersede an earlier Senior Cycle framework document *Senior Cycle Key Skills Framework* which had been published in 2009.

In December 2023 the NCAA published a further paper entitled *Technical Form of Curriculum Design*^{xli}. This was a comprehensive research paper, the terms of reference of which were “To examine relevant research and practice to help decide what format the NCCA should use when designing curriculum specifications for Senior Cycle”. The research did not focus on externally examined curriculum nor did it address the issue of assessment. The document made it clear that “the research is not intended to be indicative of what might be asked or how questions might be framed in external written examinations”. The paper included an analysis of how each of five different jurisdictions designed their senior cycle curriculum. The jurisdictions chosen were New Zealand; Ontario (Canada); Queensland (Australia); Scotland and Wales. It is notable that in the first three jurisdictions, student performance at senior cycle is assessed at school level by teachers. In the other two jurisdictions - Scotland and Wales - student performance at the end of senior cycle is externally assessed, therefore these jurisdictions are the more appropriate comparators for Ireland. However, because of concerns which have arisen about the technical form of syllabi in Scotland and Wales, as well as problems about alignment with the national externally assessed examination, at the time of writing, both of those jurisdictions are reviewing and revising their approach to syllabus design and assessment.

Arising out of the findings of the research on the technical form of curriculum design, the NCAA decided that the format of subject specifications in future would be as follows:

- Senior Cycle – purpose, vision and guiding principles;
- Rationale;
- Aims;
- Continuity;
- Key Competencies;
- Teaching and Learning;
- Strands of Study and Learning Outcomes;
- The specification for each subject to include sections on Assessment; Assessment for certification; Additional Assessment Component (AAC); Descriptors of quality for AAC; Written examination; Leaving Cert Grading.

New and Revised Leaving Certificate Subjects.

Following the Minister’s decision in September 2023 to expedite the introduction of new and revised Leaving Cert syllabi, the NCAA issued draft syllabi / specifications for nine subjects – Biology; Chemistry; Physics; Business; Arabic; Ancient Greek; Latin; Drama, Film and Theatre Studies, and Climate Action and Sustainable Development. The revised technical form of design proposed in the NCCA’s December 2023 research paper was used to design all these subjects. The text under most of the headings of each subject was largely generic and very similar in all nine syllabi. The substantive subject matter of each syllabus (the “real meat of the syllabus”) was contained in the section headed Strands of Study and Learning Outcomes. Unlike Junior Cycle specifications where there was only one column on learning outcomes, there were two columns for Leaving Certificate subjects – the first column headed “students learn about” and the second column headed “students should be able to”.

While the design template used was an improvement on that used for Junior Cycle subjects, teachers continued to have concerns^{xlii}. Their concerns related in particular to the proposal that 40% of the Leaving Cert assessment would be allocated for an Additional Assessment Component. The subject development groups for Biology, Chemistry and Physics had suggested that 20% of Leaving Cert marks would be allocated to practical laboratory work and the final specifications had been agreed in this context. Although the final specifications had not been changed, the agreed 20% was replaced by 40%. Moreover, the assessment would not be a practical assessment of experimental work observed in a science laboratory. It will simply be a written narrative descriptive piece, under a number of pre-set headings, about each student's individual experiment undertaken in a science laboratory.

Teachers have long supported the inclusion of practical assessments in science subjects at Leaving Certificate level. In 1997, the Department of Education carried out a feasibility study of practical assessment in Chemistry and Physics and in 2002 the *Report of the Task Force on the Physical Sciences* recommended that the introduction of a practical assessment component should proceed as quickly as possible^{xliii}. In 2017, a pilot project was undertaken by the SEC at the request of the Department of Education on the assessment of practical work in Leaving Cert science subjects. This report was submitted to the Department in June 2018^{xliv}. However, later that year, Minister for Education, Joe McHugh “abandoned” the idea of Leaving Cert science practicals because of the logistical and financial challenges involved^{xlv}. Instead, he asked the NCCA to explore the option of a coursework assessment – such as a project – in biology, chemistry and physics. But at that time there was no expectation that such a project would account for 40% of the total Leaving Cert marks as is now being proposed.

Inadequate Resourcing of Science Laboratories

The concerns of the teachers about the current proposals are multi-faceted. They have pointed out that many schools lack the necessary laboratory equipment and resources for students to undertake individual experiments. Most Irish secondary schools do not have access to a laboratory technician, which teachers argue would be essential if students were to undertake individual experimental work. Teachers are particularly concerned about health and safety risks associated with conducting multiple individual research investigations, especially when such experiments could run for several days or weeks.

It is notable that the State Examinations Commission itself, following the pilot project in 2017 concluded that^{xlvi}

It would not be safe to assume that laboratory facilities and equipment in schools are currently of a sufficient standard to support a rollout of this model of practical assessment without further investment, the scale of which has yet to be determined.

Generative Artificial Intelligence (AI)

Teacher concerns have been exacerbated by the availability and rapid development of Generative AI tools such as Chat GPT^{xlvii}. With recent developments in Generative AI, it is

possible to get a narrative description of a laboratory experiment written in a few minutes by one of the many available Gen AI apps without ever entering a science laboratory or carrying out an experiment.

Authentication of Student Work by Teachers

Current instructions issued by the State Examinations Commission require teachers to authenticate the AACs submitted by students. Given the high-stakes nature of the Leaving teachers are not willing to undertake such authentication^{xlvi}. In a recent survey of more than 2,700 teachers carried out on behalf of the ASTI by RedC, almost 90% of those who took part said the new Leaving Cert AACs will create difficulties when it comes to authenticating students' work^{xli}.

It is widely accepted internationally that it is virtually impossible to distinguish between text written by Chat GPT and text written by a human^l. Exam boards in other countries, and higher education institutions in this country have already adjusted their modes of assessment to take account of Generative AI. Written examinations, supervised in an examination hall, have re-surfaced as the fall-back assessment in many jurisdictions and institutions.

40% of marks for AACs is likely to widen the Gap between those from educationally disadvantaged backgrounds and their more advantaged peers.

The introduction of 40% for AACs is also likely to widen the gap between the educationally disadvantaged students and their more advantaged peers^{li}. The latter will have access to additional support from outside the classroom – from parents and relatives; from paid tutors; from access to resources and facilities which will not be available for the less advantaged. Regardless of how carefully a student's work outside a supervised examination hall is monitored, students with access to such additional support and resources will be at a advantage when preparing their AAC.

Conclusion.

Science has been included in the secondary school curriculum in Ireland since public funding was first made available for secondary education in 1878. While science is not a compulsory subject at junior cycle level, 95% of students sat Science for the Junior Cycle examination in 2024^{lii}. At Leaving Certificate level, more than 60% of students sit at least one science subject, i.e Biology, Chemistry, Physics or Agricultural Science. The numbers studying STEM subjects at university level is also high by international standards. 30% of those entering Irish universities are in the STEM area – about 40% of males and 20% of females.

The science curriculum at second level has been regularly updated since it was first introduced almost 150 years ago and the performance of Irish students in science compares favourably with their international peers. In the 2022 Programme for International Student Assessment (PISA), Irish students ranked 12th overall among OECD countries - an improvement of ten places from the previous test.

Ireland is particularly fortunate in the calibre of its science teachers at second level. They are active and articulate and keep in regular contact with each other through the Irish Science Teachers Association (ISTA) – a voluntary network. As well as providing ongoing support to its members, ISTA holds regular meetings at both local and national level and provides excellent continuing professional development (CPD) courses for its members. Members

attend these courses in their own time and at their own expense – a fact that is not always recognised or appreciated by national policymakers.

Since the 1980s, science teachers and academics have played an important and constructive role in Subject Development Groups (SDGs) convened by the National Council for Curriculum and Assessment which regularly revise and update the second level science syllabus. Tensions arose when the NCCA proposed a significant change in the template for proposed new Leaving Cert science subjects around 2012. This template, which was composed simply of Learning Outcomes and themes or topics, de-emphasised knowledge and provided only skeletal information on depth of treatment and assessment. While previous syllabi included detailed Guidelines for Teachers, the NCCA no longer proposed to provide such information. The same approach had been taken by the NCCA when revising the Junior Cycle science syllabus and teachers were very concerned about this approach.

Instead of engaging with science teachers about their concerns, the NCCA postponed the revision of the Leaving Cert science syllabi for almost a decade. It was not until 2023, and with a renewed urgency, that draft revised syllabi / specifications were issued by the NCCA using a slightly improved template. The proposals stated that 40% of the marks for the revised subjects would be allocated to an additional assessment component (AAC) – a component other than the terminal examination - a proposal which had not been agreed by the teachers or the university representatives on the SDGs. Teachers were particularly concerned that the AAC would simply consist of a written narrative describing a science experiment – there would be no practical assessment of the student’s performance. Other subjects which have a practical element, such as Art or Music or Construction Studies are assessed by a practical examination. As one teacher stated: “asking musicians to demonstrate how they play their guitar through a written report ... would be ridiculous and useless^{liiii}”. Why is such an approach regarded as appropriate for science subjects? And moreover, given the recent exponential development of Generative AI and its increasing use by students when producing written assignments, this seems a particularly inappropriate time to introduce narrative coursework worth 40% for Leaving Certificate subjects,

At the time of writing, teachers continue to express their concern about the proposed new specifications for Leaving Certificate Biology, Chemistry and Physics. The teachers and university representatives on the Subject Development Groups for these subjects have disassociated themselves for the proposal that 40% of the marks be allocated to an AAC. The Association of Secondary Teachers in Ireland, a trade union which represents almost 50% of secondary teachers, has recently voted against supporting the proposed revised syllabi and assessment. While it is not clear what implications this decision will have for Leaving Certificate reform, it is clear that there is a rocky road ahead in our second level schools. Let’s hope that the students will not be the victims in this unfortunate dispute – a dispute that could have been avoided if the educational policymakers had listened to the teachers.

THE END



REFERENCES

-
- ⁱ **Central Statistics Office (CSO).** (2023). *Census 2022 Summary Results, Series 1*. <https://www.cso.ie>
- ⁱⁱ **Department of Education (Ireland).** (2023). *Education Statistics 2022-2023*. <https://www.gov.ie/en/publication/education-statistics/>
- ⁱⁱⁱ **State Examinations Commission (SEC).** (2023). *About Us & Examination Information*. <https://www.examinations.ie>
- ^{iv} **National Council for Curriculum and Assessment (NCCA).** (2023). *Senior Cycle Overview*. <https://www.ncca.ie>
- ^v **Oide – Professional Learning for Teachers.** (2023). *About Oide*. <https://www.oide.ie>
- ^{vi} **Walsh, Thomas.** (2012). *Primary Education in Ireland 1897- 1990: Curriculum and Context*. Oxford: Peter Lang.
- ^{vii} **International Association for the Evaluation of Educational Achievement (IEA).** (1997). *Trends in International Mathematics and Science Study (TIMSS)*.
- ^{viii} **NCCA (2023) New Primary Curriculum.** <https://ncca.ie/en/updates-and-events/latest-news/2023/may/the-primary-curriculum-framework/>
- ^{ix} **Coolahan, John** (2017), *Towards the Era of Lifelong Learning: A History of Irish Education 1800 – 2016*. Dublin: Institute of Public Administration.
- ^x **Board of Intermediate Education (1921) Annual Report.** Dublin: Board of Intermediate Education.
- ^{xi} **Hyland, Áine and Milne, Kenneth** (1992), *Irish Educational Documents, Vol. 2*. Dublin: Church of Ireland College of Education.
- ^{xii} **Department of Education (1922 to 1965).** *Rules and Programme for Secondary Schools*. Dublin: Stationery Office.
- ^{xiii} *Ibid.*
- ^{xiv} **Department of Education (1965) , Rules and Programme for Secondary Schools,** page xx.
- ^{xv} **Council of Education. (1962).** *Report on the Curriculum of Secondary Schools*. Dublin: Stationery Office.
- ^{xvi} *Ibid.*
- ^{xvii} **Government of Ireland. (1958).** *First Programme for Economic Expansion*. Dublin: Stationery Office.

^{xviii} **Department of Education and Organisation for Economic Co-Operation and Development (OECD). (1965).** *Investment in Education: Report of the Survey Team*. Dublin: Stationery Office and Paris: OECD.

^{xix} **Department of Education. (1980).** *Statistical Report*. Dublin: Stationery Office.

^{xx} **Department of Education. (1970 - 1980).** *Rules and Programme for Secondary Schools*. Dublin: Stationery Office.

^{xxi} **Department of Education. (1980).** *White Paper on Educational Development*. Dublin: Stationery Office.

^{xxii} **Department of Education. (1984–1987).** *Publications of the Curriculum and Examinations Board*. Dublin: Department of Education. (Published reports and discussion papers including *Discussion Paper on Science and Technology and the Post-Primary Curriculum* (March 1987).

^{xxiii} **Department of Education and Skills. (2001).** *Education Act 1998*. Irish Statute Book. <https://www.irishstatutebook.ie/eli/1998/act/51/enacted/en/html>

^{xxiv} **National Council for Curriculum and Assessment (2025)** *About the NCCA*: <https://ncca.ie/en/about-ncca/>

^{xxv} **National Council for Curriculum and Assessment (2004).** *Update on the Junior Cycle Review*.

^{xxvi} **National Council for Curriculum and Assessment (1988).** *Comhairle – Information Bulletin of the National Council for Curriculum and Assessment*.

^{xxvii} **Department of Education and Skills. (2003).** *Establishment of the State Examinations Commission*. Statutory Instrument No. 373 of 2003. <https://www.irishstatutebook.ie/eli/2003/si/373/made/en/print>

^{xxviii} **National Council for Curriculum and Assessment (NCCA). (2000).** *Leaving Certificate Chemistry Syllabus*. https://www.curriculumonline.ie/getmedia/e343c746-ea78-4876-a83e-216f13b87b82/LC_Chemistry_Syllabus.pdf

^{xxix} **State Examinations Commission statistics 2024.** <https://www.examinations.ie/statistics/>

^{xxx} **National Council for Curriculum and Assessment (NCCA). (2003).** *Directions for Development: Senior Cycle Education*. <https://ncca.ie/en/resources/directions-for-development>

^{xxxi} **National Council for Curriculum and Assessment (NCCA). (2009).** *Towards Learning: An overview of senior cycle education*. https://ncca.ie/media/1356/towards_learning.pdf

^{xxxii} **National Skills Strategy. (2007).** *Tomorrow's Skills: Towards a National Skills Strategy*. Department of Enterprise, Trade and Employment. https://skillsstrategy.ie/PDF/Tomorrow_Skills_Towards_National_Skills_Strategy.pdf

^{xxxiii} **Hyland, Áine** (2014). *The Design of Leaving Certificate science syllabi in Ireland: an international comparison*. (Report prepared for the annual conference of the Irish Science Teachers Association 12th April 2014).

^{xxxiv} **Kennedy, Declan** (2019). “Moving from Junior Cycle Science to Leaving Certificate Sciences” in *Science*, November 2019.

^{xxxv} **Irish Science Teachers Association**. (2019 – 2024). Various editions of the ISTA journal *Science*.

^{xxxvi} **Association of Secondary Teachers in Ireland (ASTI)**. (2022). *Teachers’ experiences of the implementation of the Framework for Junior Cycle*. ASTI.
<https://www.asti.ie/document-library/teachers-experience-of-the-implementation-of-the-framework-for-junior-cycle/>

^{xxxvii} **Joint Oireachtas Committee on Education, Further and Higher Education, Research and Science** (2022 and 2023) *Learning for Life and The Future of STEM in Irish Education*, Dublin: Houses of the Oireachtas. <https://www.oireachtas.ie/en/press-centre/press-releases/20230713-the-joint-committee-on-education-further-higher-education-research-innovation-science-has-published-its-report-on-the-future-of-science-technology-engineering-and-maths-stem/>

^{xxxviii} **Department of Education** (2022). *Equity and Excellence in Education: Policy Vision for the Reform of Senior Cycle Education in Ireland*. Dublin: Department of Education.: <https://www.gov.ie/en/publication/984d2-senior-cycle-reform/>

^{xxxix} **Department of Education** (2023). *Minister Foley outlines phased implementation of Senior Cycle reform*. Press Release, 21 September 2023. <https://www.gov.ie/en/press-release/>

^{xl} **National Council for Curriculum and Assessment (NCCA)** (2023). *Key Competencies in Senior Cycle Design*. Dublin: NCCA: <https://ncca.ie/en/resources/key-competencies-in-senior-cycle-design/>

^{xli} **National Council for Curriculum and Assessment (NCCA)** (2023). *Technical Form of Curriculum Design*. Dublin: NCCA, December 2023. <https://ncca.ie/en/resources/technical-form-of-curriculum-design/>

^{xlii} **See for example Irish Science Teachers Association**. (2024). *ISTA Statement on “Additional Assessment Components” in the proposed Senior Cycle Science Specifications* 13th December 2024.
<https://ista.ie/2024/12/#:~:text=Month%3A%20December%202024&text=At%20last%20Friday's%20ISTA%20Council,the%20revised%20Senior%20Cycle%20Biology%2C%E2%80%A6>

^{xliii} **Department of Education and Science** (2002). *Report of the Task Force on the Physical Sciences*. Dublin: Government Publications.
<https://www.education.ie/en/publications/education-reports/>

^{xliv} **State Examinations Commission. (2018).** *Report on the Trialling of the Assessment of Practical Work in Leaving Certificate Biology, Chemistry and Physics.* (available on ISTA website).

^{xlv} **Katherine Donnelly (2018).** “Practical science Leaving Cert ruled out over cost and crowded school curriculum” in *Irish Independent*, 11th December 2018.

^{xlvi} **State Examinations Commission. (2018).** *Op.cit.*

^{xlvii} **Emma O’Kelly (2025).** “Teachers Worry over AI impact on Senior Cycle Reforms”. *Blog on RTE website*, 10th February 2025.

^{xlviii} **John Conneely (2025).** “Authenticating work of students”. Letter to the *Irish Times* 25th January 2025.

^{xlix} **ASTI/Red C Research (2024).** *Teacher Attitudes to Senior Cycle Reform – National Survey Report.* Dublin: ASTI.: <https://www.asti.ie/news-campaigns/latest-news/>

ⁱ **OpenAI (2023).** *ChatGPT and Education: Considerations for Assessment Integrity.* (Refer to OpenAI blog or academic discussions on Generative AI in education.) Blog: <https://openai.com/blog>

ⁱⁱ **Sarah O’Mahony. (2025)** “Senior Cycle reforms could put rural and disadvantaged students at risk, study finds” in *Irish Independent*. 1st February 2025.

^{lii} **State Examinations Commission (2024)** *Annual Examination Statistics.* <https://www.examinations.ie/statistics/>

^{liii} **Adrienne Healy, quoted in Carl O’Brien (2025),** “‘It’s Impossible’; Will teachers be able to stop cheating for new Leaving Certificate coursework?” in *Irish Times*. 22nd April 2025.