



*Irish
Science
Teachers'
Association*
Eolaíocht
na hÉireann

30/10/2019

Submission to NCCA by ISTA re Senior Cycle Review with particular reference to Leaving Certificate Biology, Chemistry and Physics

1. Introduction

The Irish Science Teachers' Association was founded in 1961 and is one of the largest subject associations in Ireland. In excess of 1200 teachers from all sectors of education are members. The ISTA functions as a body dedicated to the professional development of its members and the advancement of science teaching. Membership is open to teachers of science and to others involved in science education.

The Association works on a voluntary basis to develop co-operation between teachers of science at all levels. One of the aims of the ISTA is to promote science education at local, national and international level. It consists of a network of fourteen branches at local level, a Council and an Executive at national level. The ISTA is an active member of the International Council of Associations for Science Education (ICASE) and is represented on the Executive of ICASE. Through its CPD programmes at local and national level, the ISTA keeps its members up to date with developments in science education at national and international level. In addition to its work with the Department of Education and Skills and NCCA, the ISTA also works in close partnership with industry through corporate membership of ISTA and third level institutions through its third level membership programme

The ISTA welcomes the opportunity to respond to the invitation from the NCCA to make this submission regarding the proposed new specifications in Leaving Certificate Biology, Chemistry and Physics. Since the NCCA was established on a statutory basis in 2001 the ISTA has been represented on all Junior Cycle science and Leaving Certificate biology, chemistry and physics subject development groups. Prior to the establishment of the NCCA, the ISTA was also represented on the Department of Education syllabus committees and has always worked in close partnership with both the Department of Education and Science and the NCCA.

2. The experience of Junior Cycle science informing the development of the new specifications in Leaving Certificate biology, chemistry and physics

Since the introduction of the Junior Cycle science curriculum in September 2016, various discussions have been held at ISTA Council meetings about teachers' experiences of implementing this curriculum in the classroom. Arising out of these discussions, the ISTA issued a questionnaire to science teachers throughout the Republic of Ireland during the period February - March 2019. The purpose of the

questionnaire was to enable science teachers to give feedback on their experience of teaching the Junior Cycle science specification

The responses from science teachers in the light of their experience of teaching the new Junior Cycle science curriculum are presented in the report *Listening to the Voice of Science Teachers* (ISTA 2019). A total of 762 teachers responded to the questionnaire. A copy of the preliminary report is available online (ISTA 2019) and we encourage the NCCA Executive and Council to read the full report. In this submission, we wish to concentrate on the responses by teachers to two questions in the survey as these two questions are particularly relevant to the development of the Leaving Certificate science specifications.

Question 9 of the survey asked teachers to indicate on a five-point scale their opinion on the extent to which they feel that students will be prepared for the study of Leaving Certificate science subjects by the Junior Cycle science specification. The results are summarised in Figure 1.

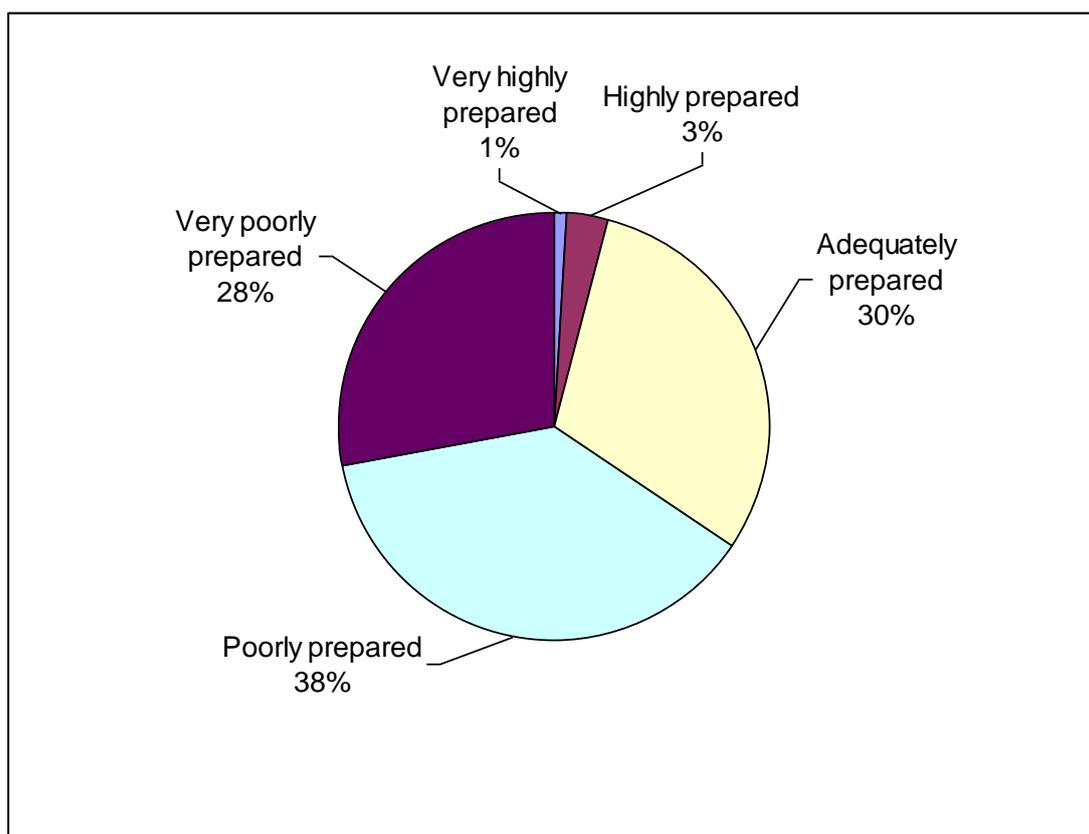


Figure 1. The extent to which science teachers feel that students will be prepared for the study of Leaving Certificate science subjects by the Junior Cycle science specification

As can be seen from the statistical analysis, a total of 66% of teachers felt that students would be either poorly prepared (38%) or very poorly prepared (28%) for the

study of Leaving Certificate science subjects. A number of themes emerged from the comments of these teachers.

2.1 Depth of knowledge

A majority of teachers expressed concern about the **depth of knowledge** of the students. Some examples of comments made by teachers were:

Students will be lacking in much of the basic content knowledge which is assumed to be known/familiar to them. Rigorous definitions, mathematical work and theoretical knowledge are things they will not have encountered in Junior Cycle.

The science content which students need to know is very basic, students will be ill prepared for Leaving Cert physics in particular I feel without having any experience with magnetism, sound, light, limited interaction with other areas. They may have developed a greater skill level in some areas, however, KNOWLEDGE is greatly diminished. Unfair on students as there is an inequality on what EXACTLY is covered by the teacher for each learning outcome - could be significantly different, from teacher to teacher or between schools

Urinary system, senses, skeleton, plant structure all gone in bio, chemical bonding merely brushed over in chemistry, light, sound and magnetism reduced to a mention in physics! Major dilution on all fronts, yet the LC syllabus the same. Matter of time before this diluted too, but surely that is not the solution!

Students can now finish Junior Cycle science without ever hearing the term "chemical bonding", will know nothing about the composition of the air or water treatment, will know nothing about light, sound or magnetism, will know nothing about static electricity, will not even be able to wire a three-pin plug, will know nothing about the skeletal system or muscular system, sensory system, the eye, plant structure, plant reproduction or tropisms. All of these topics serve as foundation stones for the study of the science subjects at Leaving Certificate.

The Junior Cycle has prioritized development of skills at the expense of knowledge and this will not prepare pupils for leaving certificate

Students are unable to sit down and learn anything. They are lacking the skill of learning. Whether it is active or not students need to learn and retain information. I have found there is a decrease in interest in picking a LC Science subject compared to previous years gone by.

2.2 Lowering of standards of science

The majority of teachers also expressed concern about the **lowering of standards** in the new specification.

The course is completely dumbed down and those that may go into STEM careers are not getting enough teacher time to develop their aptitude for the subjects.

Lacking basic scientific principles for senior cycle science subjects. Dumbed down syllabus with no emphasis on learning information.

The body of knowledge with which they move forward to senior cycle in chemistry, biology and physics is so watered down it will be a massive struggle to bring them up to speed to begin teaching any of these subjects at senior cycle...dumbing down comes at a high price...

All students now taking a common level, not good for preparing for definite LC levels. Basics on heat, light and sound are now removed/optional from the course. Having no set experiments to cover means that students prior knowledge entering LC science, will depend a lot on their JC teacher and what they decided to do.

The lack of depth of treatment with respect to the learning outcomes is going to have an impact. For example the learning outcome CW5 refers to using the Periodic Table to find ratio of atoms in compounds yet at no stage mentions ionic or covalent bonding. I could teach this ratio and never mention these key terms and fundamental aspects of chemistry.

The physics section of the course is very short. Standards are "dumbed down" across physics, biology and chemistry.

Basic scientific principles are not being taught now. We are teaching them how to find out information not the information itself

Not prepared at all the better students want to learn and the new science course does not place value on this and the vagueness of the course does them an injustice

2.3 Gap between Junior Cycle and Leaving Certificate

The majority of teachers felt that the gap between Junior Cycle science and Leaving Certificate science subjects had widened.

The gap has widened even more students will struggle with the high demands at LC on theory.

Course does not prepare students at all for senior cycle chemistry. Very concerned.

Before the Junior Cycle Science there was already a big gap going to senior level. I believe this gap is going to widen with reduced teaching time and time spent on CBA 1 and 2.

There is no comparison. The new Junior course is almost "paint by numbers", the jump in the level of detail required for Leaving Cert is galaxies away and ultimately I think will put students off the sciences, or in my worst fear scenario the Department will read that as.... let's dumb down the Leaving Cert so the new Junior Cycle doesn't look like a failure!

There was always a big gap, but now it is CAVERNOUS!! Imagine going to LC Chemistry and never having heard of an ion! It is now possible.

Massive gaps in knowledge going into Leaving Cert Biology, cannot comment on the other science areas.

The jump from Junior Cycle to Senior Cycle has widened. Some of the basic concepts will need to be taught to bridge the gap, putting increased pressure on students and teachers at senior cycle.

Because no two teachers doing any of the same material at anything approaching the same depth, not sure what basic scientific knowledge any students will have on topics such as Force, Energy, atomic theory, human or plant biology, experimental write ups, chemical equations, Electricity to name just a few. Having completed this new course I'm not sure what exactly they will have really learned or indeed understood so will feel the need to almost begin from scratch when starting with students in Leaving cert. The jump from this common level paper to higher level present leaving Biology, chemistry or Physics is so huge are afraid they solution that will be to bring the senior cycle course down to this level.

We are now dealing with two mismatched syllabi: JCT is a skills based course, while traditional LC is a knowledge based course.

The attitude of the students coming out of their pre exams was that they could answer most of the questions without ever having been to a science class. This is very different in Leaving Certificate biology.

A lot of the content needed for LC subjects is gone. For example, bonding in JC chemistry - it is no longer specified that ionic and covalent need to be covered so that will have to be covered. The vague nature of the learning outcomes mean that teachers may interpret them differently and so, may teach different things.

Many shortcomings one being lack of experiments being done all is lost in teaching of Science so sad after 39 years of teaching with excellent results teaching through experiments can teach science in classroom now all is lost

The topics have been watered down that unless there is a focused TY to bridge the gap the students understanding will be left wanting.

The parts of the course which have been removed to make room for the Earth and Space unit has resulted in students having no knowledge of key areas required for Leaving Certificate science subjects. There is no plant biology at junior cycle which makes up a large proportion of leaving certificate biology.

Students are finishing the Junior Cycle with a very basic and vague reality of Leaving Cert science. Interpreting information, processing it and understanding it is great in theory, but there's only so far a 15-year-old can explore into that. It leaves a huge gap when they arrive at Leaving Cert level and all of a sudden have mandatory practicals, definitions and highly wordy questions that they have never experienced before, even at a more basic level.

No basic laboratory skills across the board with students. Not every student will enter the Leaving Certificate classroom with the same skills. No emphasis on writing as a

scientist. As a biology teacher students have no introduction to plants except for photosynthesis and the plant cell. This is not sufficient for leaving certificate biology.

Depending on the depth of treatment by teacher on each topic this gravely varies from classroom to classroom never mind school to school. This leaves some students at a disadvantage in certain topics or areas

2.4 Concerns regarding physics

In particular, many physics teachers expressed concern for their subject.

There was always a gap between LC Physics and JC Physics. However, there is so little now of Physics in the New Junior Cycle, it will very difficult to encourage students not only to choose LC Physics but also to complete it...making it much more difficult.

..... I do not know where to begin with regards to LC Physics. I feel as if my course is decimated and I know that teachers are not giving Physics the same time to Physics as to Biology/Space/Chemistry. This course is going to be the end of Physics as a mainstream LC course.

I teach Physics. There is no way coming from the Junior cycle science curriculum, the students are able for the workload and intensity of Leaving Cert physics

I teach Leaving Cert physics and have serious concerns that those students who might actually choose my subject will be at a huge disadvantage to previous years based on the few physics concepts I have touched on at JC

As a teacher of LC Physics, I feel that most/many of the topics covered will require a lot more base knowledge teaching in order to get off the ground. Also, there is the risk of inconsistency; one teacher did teach heat transfer methods and others didn't. The uniformity of the students' knowledge will be affected.

As a physics teacher I'm forever worrying that no emphasis is placed on calculations and that some important sections at LC level can be omitted at JC in order to cover the specification e.g. Light and sound

The huge loss of many Physics topics will have an enormous impact on the future Leaving Cert Physics students.

Especially physics - can get through junior cycle without mentioning sound, light, magnetism, latent heat, heat. Also biology - no plant reproduction, excretory and skeleton and sensory system.

The new JC Physics in particular falls far short of providing a proper foundation for the existing leaving cert Physics.

Physics at JC has been decimated

AS a LC Physic teacher I feel the 'watering' down of content does not prepare students for the traditional LC course. There are now many gaps in learning to be

filled. While it is argued that students have gained valuable skills they go into senior cycle lacking knowledge in specific topics. I will definitely have to teach a lot more core content (which would have been covered on the previous syllabus at JC)

They won't be very well prepared for physics at all. The syllabus needs to include more advanced detail to ensure that enough is covered to support leaving cert science students.... these students will get a big shock in fifth year

No physics left in Junior Cycle, students will be very unfamiliar. Assessment styles are very different and the absence of mandatory experiments on junior Cycle when they are mandatory at leaving cert is problematic.

The lack of Physics on the course will disengage students with the subject and turn them off. Also the amount of gaps in the course. Where are the basics such as light, magnetism, static electricity, heat???

It is clear from the responses of the teachers in the classroom that these teachers have major concerns regarding the extent to which they feel that students will be prepared for the study of Leaving Certificate science subjects having studied Junior Cycle science. In particular, these concerns relate to the depth of knowledge, lowering of standards of science, the increased gap between Junior Cycle science and Leaving Certificate science and the concern among physics teachers for the future of their subject.

3. The template being used to design the new specifications in Leaving Certificate biology, chemistry and physics

In question 16 of the report *Listening to the Voice of Science Teachers* (ISTA 2019) teachers were asked about their experience of the new template of specification at Junior Cycle science.

16. Based on your experience of working with the new template of specification at junior science level, please indicate how you would feel if the specifications at Leaving Certificate sciences would be presented using the same template.

Very satisfied **Satisfied** **Dissatisfied** **Unacceptable**

Please explain.

The responses from teachers are summarised in Figure 2.

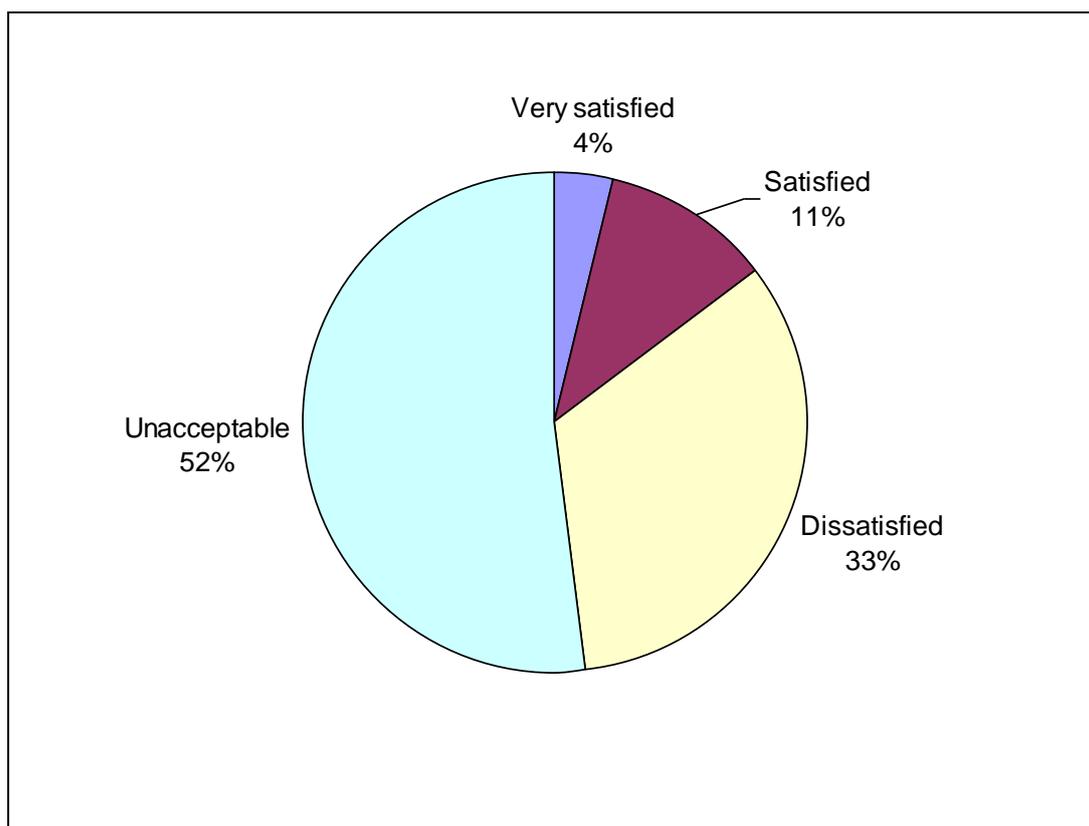


Figure 2. The level of satisfaction indicated by teachers if the same template used in the Junior Cycle science specifications were to be used for the new Leaving Certificate biology, chemistry and physics specifications.

The fact that 85% of teachers described their level of satisfaction as either “unacceptable” or “dissatisfied” is a very strong indicator that teachers in the classroom have found serious problems with the template of the Junior Cycle science specification. Teachers were also asked to explain the reasons why they chose a particular option and these reasons are now summarised.

3.1 Vagueness of learning outcomes

Many teachers commented on the **vagueness of the learning outcomes** and the need for **depth of treatment** to be supplied.

The learning outcomes do not give enough information about depth of treatment and are open to interpretation by teachers and the State Examinations Commission

The vagueness of the Junior Cycle needs to be clarified first. Teachers are still getting to grips with the new course. Leaving Certificate reforms while necessary should not be rushed in until a full assessment of the success of Junior Cycle has been carried out.

The new JC specification is not a specification as it is not specific at all. I have worked in the UK and have seen what a specification should look like. This vague use of a list of learning outcomes only resulted in every school wasting many hours with pointless paperwork such as the unpacking fiasco.

Too much work trying to "unpack the learning outcomes". Just spell it out clearly and let us get on with teaching.

I actually would consider leaving teaching. Totally unacceptable for students to be sitting a common exam without a detailed syllabus so that every student in the country has the exact same opportunity. It should not be up to teachers to decide WHAT to teach, it is up to teachers to decide HOW best to teach it.

Current JC specifications give no detail or guidelines on the depth of treatment required. The specifications are anything but specific.

What exactly is wrong with actually indicating the depth of treatment needed for each topic? The current JC specifications basically mean that different teachers can teach different topics to totally different levels with totally different time allocations. How can that be acceptable?

My JC students have been used as guinea pigs to implement this new JC course I as a teacher would not be able to stand over the same at senior cycle. We did not get adequate training. A DEFINITE SYLLABUS IS REQUIRED FOR SENIOR CYCLE.

The template being used at Junior Cycle level is simply dreadful. The specification consists simply of a list of learning outcome with no details of depth of treatment. In a recent article in the Irish Times on 26 February 2019, the teacher who wrote the article described Junior Cycle reform as resembling "an IKEA-style flat pack but with no accompanying instructions". I fully agree with this sentiment. At the JCT courses a lot of time was spent telling us how to "unpack the learning outcomes". It is not the job of the teacher to interpret the learning outcomes. It is not our job to try to read the minds of those who designed the specifications. It is the job of the NCCA and its committees to draw up syllabi of international standard as outlined in the Hyland Report. It is the duty of the NCCA to provide proper syllabi as we have at present in Leaving Certificate biology, chemistry and physics. Leaving Certificate syllabi need to be properly designed and fit for purpose.

It involves a lot of guess work and I am bombarded with so many initiatives that I am seriously considering retiring early. Just tell us what to teach and let us get on with it

3.2 High stakes examination

Many teachers commented on the unsuitability of the template for a **high stakes examination**.

No depth of treatment provided, will lead to complete lack of standardisation and quality of teaching and learning will plummet. Until NCCA are willing to give a proper syllabus with depth of learning provided - this specification approach will not meet the needs of students or teachers. It has already been demonstrated through Professor Áine Hyland's report that a proper syllabus is needed. Stop wasting our time with this ambiguous document ("specification")

The specifications are far too broad and open to too many different interpretations. The courses that are highly regarded by international standards (e.g. the IB) have much more specific syllabuses so that the students are very clear about what they

need to know. In order for a system to be fair and well regarded there needs to be a clear understanding of exactly what a student is expected to be able to do. The depth to which each topic needs to be taught has to be clear, otherwise it could leave some students at a disadvantage depending on how their teacher interpreted each learning outcome. Changing the Leaving Cert to be like the Junior Cycle would have a hugely negative impact on how the standard of the Irish education system would be judged and would make the process much more unfair on the students. It would be a tragedy.

Vague learning outcomes will lead to further dumbing down and a decrease in the quality of the Irish education system that will have serious long term negative effects on the education system and economy.

Students' futures should not be down to interpretation of woolly vague specifications

Far too vague for such a high stakes exam.

Having dumbed down the Junior Cycle we now intend to dumb down the Leaving Cert. also? We will end up destroying the Irish education system

They would know very little content at a very vague level and would not be able to cope with science courses at university level. We are being constantly told we have to share learning intentions with students but how can I do that when I don't know exactly what they need to know. How can they have a high level of science required for university with such a wishy washy foundation. Totally unacceptable. The only hope universities have of decent science students is if we undo the damage Junior Cycle has done.

I feel at present the LC Chemistry syllabus is generally good. I believe it provides a good all round foundation for life/ future chemistry careers. I would be extremely unhappy with the learning outcome approach with a lack of depth of treatment.

It would be a destruction of the current excellent syllabi, a further dumbing down of the subjects and very hard to teach without clear learning outcomes.

3.2 Increased stress on students and teachers

There was a strong emphasis placed by teachers on concern that vague syllabi at Leaving Certificate would lead to **increased stress** being placed on students and teachers.

Teachers are left to work out what's on the syllabus for themselves. The stress of this is frightening. A disaster if brought in at Leaving Cert.

The new JC science is a disaster. Students hate it and as teachers we are completely stressed with the lack of guidance. Science is a factual subject and students need to learn the basic facts before they can plan investigations etc.

The non-defining of the Junior Cycle syllabus has led to increased stress for both pupils and teachers. The contents of the textbooks vary so much that it is impossible to know how best to advise students on learning. This level of uncertainty is detrimental

to wellbeing. I would hate to put our Leaving Cert students through a similar process.

I honestly feel if the LC changed in the same manner as the new Junior cycle that it would be to the detriment of the Irish education system and standard of students presented to higher education. The students would be incapable of actually learning important pieces of information. The absolute vagueness of the learning outcomes would put a strain on teacher student relationships, where I wouldn't even have confidence in myself as a teacher that I would be pointing them in the right direction.

I think the way the new Junior Cycle was bought in was disgraceful. Very little information, very little thought behind the assessments. Assessments that take up a lot of class time but have no real importance. A slow dribbling release of resources.

*I couldn't face another 2/3 years of teaching the unknown. Please no!!!!
Student anxiety might be an issue as it is unfortunately a high stakes exam*

The level of anxiety experienced by LC students would have detrimental effects to all.

It needs to be clear what has to be taught. Cannot afford the ambiguity or guess work at leaving cert level

With students' futures directly affected by their LC I could not work with the ambiguity of the learning outcomes system as it stands. It would cause extreme stress and anxiety for both students & teachers I believe. For example, 'a range of separation techniques'.... how many? What if I do 4, but the exam paper asks about the 5th we didn't cover. It is too vague

We need to know exactly what to teach. This becomes vital given the significance of the Leaving Cert exam to our student' futures.

Specification is far too vague, "unpacking" very stressful, time consuming and open to interpretation...

I would be horrified!! I need a syllabus that is understandable and written in plain straightforward English which clearly states what the students precisely need to know (just like the current Leaving Cert. syllabus) and what experiments they need to have done. I also do not want to see any reduction in contact time with classes as I struggle as it is to cover the course in the time allowed.

In view of the serious difficulties experienced by teachers in using the Junior Cycle science template of curriculum design, we request the NCCA to use a revised template to include depth of treatment in the new Leaving Certificate biology, chemistry and physics specifications.

4. The Hyland Report

In the *NCCA Draft Background Paper and Brief for the review of Leaving Certificate Physics, Chemistry and Biology*, it is stated that “new specifications for Leaving Certificate physics, chemistry and biology are scheduled to be introduced in 2021. The curriculum specification for each subject will be published a year earlier in September 2020” (NCCA, 2019). The ISTA views with concern the fact that the new specifications will

be finalised over the coming months before the review of Senior Cycle has been completed and before any review of the effectiveness of Junior Cycle and the implications for Leaving Certificate have been completed.

Drafts of the proposed new Leaving Certificate specifications were completed in 2014. As the NCCA is aware, these draft specifications caused alarm among several members of the subject development groups with responsibility for developing the new specifications. Members of the subject development groups were told that it was NCCA policy that specifications would be presented in the template that consisted simply of a list of learning outcomes. The reports of the ISTA convenors were discussed at ISTA Council which expressed its concern to the NCCA as far back as 2013 when it wrote to the NCCA as follows:

“In terms of structure and clarity of depth of treatment, the Leaving Certificate syllabi in biology, chemistry and physics currently being taught in schools are far superior to the proposed draft syllabi recently circulated. The essential problem with the proposed draft syllabi is that they simply contain a list of learning outcomes with no indication regarding depth of treatment or range of subject knowledge associated with these learning outcomes. **We request that this depth of treatment and range of subject knowledge be integrated into the draft syllabi (as is the case with the syllabi currently being taught) before they are finalised by the Council of the NCCA.** It is vital that this important material is embedded into each of the syllabi and not made available as separate documentation at a later stage. Even highly experienced science teachers at our ISTA Council meeting found problems with interpreting many of the learning outcomes. It is clear that there is still a considerable amount of work to be done in order to reduce the “fuzziness” of these draft syllabi and thus bring them up to the standard of the current Leaving Certificate biology, chemistry and physics syllabi.”, Figure 3.

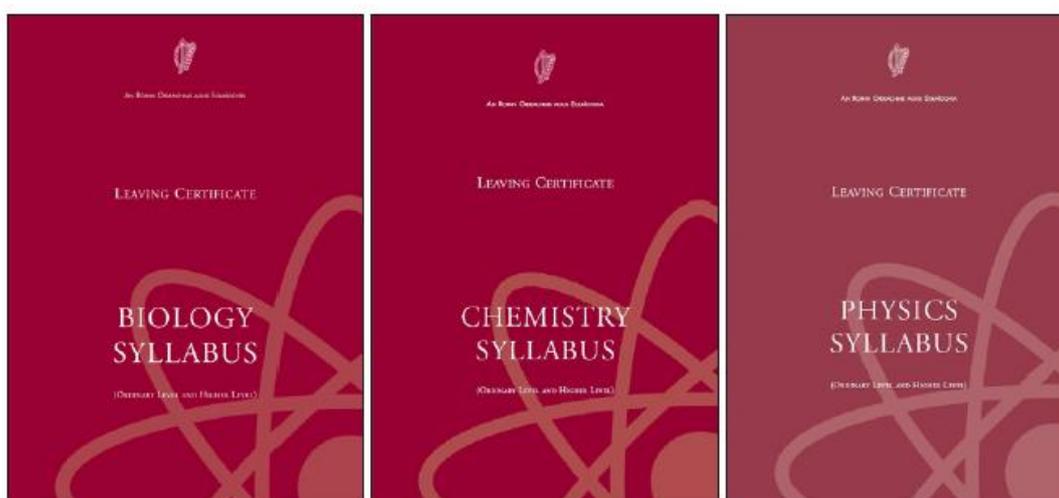


Figure 3. The current Leaving Certificate biology, chemistry and physics syllabi are detailed documents which contain depth of treatment, social and applied aspects as well as details of student and teacher activities and laboratory practical work.

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 to carry out research on curriculum design at international level. 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.

In the recently published *Draft Background Paper and Brief for the review of Leaving Certificate physics, chemistry and biology* (NCCA 2019) the following is stated:

Given the concerns expressed by many stakeholders about the enactment of the specifications following the consultation on the draft specifications in 2014 (Hyland, 2014), it is clear that many stakeholders in Ireland do not easily see the potential of learning outcomes to support them to design and deliver appropriate programmes for the students in their contexts". (NCCA 2019 p.24)

We wish to state that the ISTA is not opposed to the concept of learning outcomes - science teachers use them every day in the classroom in their design of lesson plans. However, learning outcomes on their own are of little value unless accompanied by depth of treatment to clarify what exactly is meant by the learning outcome. For example, one could write the same learning outcome for students in primary school, secondary school or third level. Thus, learning outcomes are meaningless without additional information on the depth and range of subject knowledge being examined. The ISTA report *Listening to the Voice of Teachers* provides ample evidence for this fact as teachers struggled to try to make sense of many of the learning outcomes listed in the Junior Cycle science specification.

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 the design of science syllabi and focused on Scotland, Australia and also on the International Baccalaureate system as exemplars of good practice. The Hyland Report was launched in 2014 at the ISTA Annual Conference in NUIG, Figure 4.

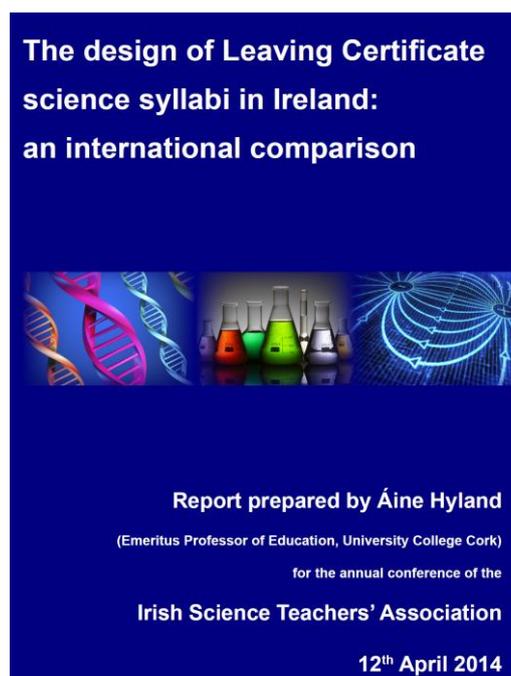


Figure 4. Professor Áine Hyland’s report was based on the drafts of the 2014 Leaving Certificate biology, chemistry and physics specifications. These drafts are currently under discussion by the NCCA subject development groups and the specifications are due to be finalised in 2020.

A short summary of the Conclusions and Recommendations of the Hyland Report is now given.

Conclusions of the Hyland Report

The six main conclusions may be summarised as follows:

1. **Depth of treatment.** The lack of depth of treatment in the proposed Leaving Certificate biology, chemistry and physics specifications is **not** in keeping with best international practice. After carrying out her analysis of curricula at an international level Professor Hyland states that “in every public examination system identified for this report, the syllabi for the end of senior cycle examinations include considerable detail about depth of treatment, examination specification, practicals and laboratory experiments and other advice for teachers and pupils. While learning outcomes are specified in all the syllabi, they are only one element of the detail provided. (p. 5 Hyland Report).

The problem with lack of depth of treatment is highlighted in Table 1 (p. 21 Hyland Report).

Table 1 Comparison of syllabus lengths

	Current syllabus	Draft specification
Biology	38 pages (p.7 – 44)	13 pages (p. 19 – 30)
Chemistry	35 pages (p. 37 – 71)	18 pages (p.20 – 37)
Physics	20 pages (p. 25 – 44)	12 pages (p. 21 – 33)

2. More work required on the draft specifications. Professor Hyland points out that more work is needed on the draft specifications in biology, chemistry and physics in order to bring them up to international standard: “While the current NCCA draft specifications may be a valid first step in outlining the syllabi, this researcher agrees with the ISTA that it is not sufficient to describe a high-stakes examination programme in terms merely of topics and learning outcomes. 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.” (p. 42 Hyland Report)

3. Need to improve template being used by NCCA for specification design. It is clear from the reports of the ISTA representatives working on NCCA subject development groups that considerable frustration was experienced as a result of all three science specifications being forced into a template consisting of nothing more than a list of learning outcomes. Professor Hyland points out that the practice of the NCCA in designing specifications that consist solely of a list of topics and learning outcomes is not good practice in curriculum design and that “this researcher has not come across any centralised or public examination syllabus at this level which provides only a list of topics and learning outcomes. (p.5 Hyland Report). In addition, Professor Hyland points out that “while learning outcomes are a very valuable tool for identifying what learners should know and be able to do at the end of a course or programme, it is not appropriate to use learning outcomes alone to define a syllabus and its assessment.” (p. 5 Hyland Report).

4. Concerns identified in NCCA benchmarking exercise. Professor Hyland expresses concern with the benchmarking exercise used in designing the Leaving Certificate Science syllabi: “It would appear that for international benchmarking purposes, the NCCA has used the curriculum framework *Curriculum for Excellence* of Education Scotland, and the national curriculum framework for the whole of Australia, set by the Australian Curriculum, Assessment and Reporting Authority (ACARA), rather than the examination syllabi provided by the Scottish Qualifications Authority (SQA) and by the Victorian Curriculum and Assessment Authority (VCAA), which in the view of this researcher are the more relevant benchmarks.” (p. 41 Hyland Report). Having expressed concern at the benchmarking exercise, Professor Hyland provides very good evidence to support her concern at the quality of the benchmarking exercise carried out by the NCCA. She compares three chemistry syllabi (Scotland, Australia and International Baccalaureate) with the NCCA draft Leaving Certificate Chemistry syllabus: “Comparing these three chemistry syllabi with the NCCA draft specification for Leaving Cert chemistry, one notes a significant difference in approach between the three systems chosen and the approach of the NCCA. While the NCCA document resembles, to some extent, the national curriculum and assessment guidelines of Education Scotland, or the curriculum and assessment guidelines of the Australian Curriculum and Assessment Authority it does not resemble the detailed examination syllabi provided by the examining and awarding bodies in Scotland (the Scottish Qualifications Authority), in Victoria, Australia (the Victorian Curriculum and Assessment Authority) and the International Baccalaureate Organisation (IBO).” (p. 41 Hyland Report).

5. Fall in standards of science. Professor Hyland warned of the dangers of writing specifications solely in terms of a list of topics and learning outcomes as this could

lead to a fall in standards: “Learning outcomes are statements of essential learning, and as such they are written at minimum acceptable or threshold (pass / fail) standard. If teachers focus only on learning outcomes, there is a real risk that the teaching and learning targets will be at a minimum rather than a maximum level, that the bar will not be set high enough for student learning, and that as a result, standards will fall” (p. 5 Hyland Report). Professor Hyland also points out that the design of the Leaving Certificate biology, chemistry and physics syllabi currently being taught in schools are of a high standard with a format that is “consistent and clear across subjects” (p. 12 Hyland Report). The report also states that “the current Leaving Certificate physics, chemistry and biology syllabi, which have been implemented since the early 2000s, are highly regarded by teachers and have contributed to a reversal of the decline in the numbers of pupils taking science subjects at senior cycle” (p. 40 Hyland Report).

6. Rote learning. In Chapter 4 of the Hyland Report, it is made very clear that there is no link between giving detailed depth of treatment and rote learning: “The international comparisons in Section 2 of this report show that it is possible to provide syllabi or examination programmes which include detailed guidelines; teachers’ notes; assessment specifications etc. while at the same time devising an approach to assessment which does not reward rote-learning and ensures that higher order skills are recognised and rewarded. To my knowledge, it has never been suggested that the detail provided by the IBO Diploma syllabi or the Scottish Highers or the Victorian Certificate of Education has led to or leads to rote-learning.” (p.39 Hyland Report).

Recommendations of the Hyland Report

The ISTA requests that the three main recommendations of the Hyland Report be implemented in full:

1. Leaving Certificate specifications 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.” (p. 5 Hyland Report). Professor Hyland also recommends that the depth of treatment of the draft Leaving Certificate biology, chemistry and physics specifications should at least be brought up to the standard of the current syllabi being taught in schools at present: “It is the considered view of this researcher that the final versions of the proposed new syllabi for physics, chemistry and biology, should contain at least the same depth of treatment as is available in the current syllabus documents, as well as detailed examination specifications and Teachers’ Notes. When approved by the Minister, the full range of documentation in relation to each syllabus should be published online and in hard copy under the logo of the Department of Education and Skills, prior to the implementation of the syllabi.” (p. 44 Hyland Report).

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” (p. 5 Hyland Report). Details of examples of syllabi documentation in Scotland (200 pages approx), Australia (200 pages approx.) and the International Baccalaureate (150 pages approx) are included in the report (see p. 26 -36 and p. 40-41).

3. Depth of treatment 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.” (p. 43 Hyland Report).

Conclusions

It is hoped that the experience gained by teachers in the light of teaching the new Junior Cycle science specification will be taken into account in designing the new Leaving Certificate biology, chemistry and physics specifications

It is clear from the report *Listening to the Voice of Science Teachers* (ISTA 2019) that it would be intolerable and a source of great stress and anxiety to teachers and their students if teachers themselves have to interpret or "unpack" learning outcomes in the new Leaving Certificate biology, chemistry and physics specifications to try to work out for themselves the depth of treatment relating to each learning outcome.

The fact that science teachers have overwhelmingly stated that it would be unacceptable for the same template of specification design to be used in the proposed new Leaving Certificate biology, chemistry and physics specifications must be taken into consideration. The solution to the problem is straightforward: the recommendations of the Hyland Report must be implemented in full in order to bring the specifications up to international standard. We look forward to working in partnership with the NCCA and the Department of Education and Skills to ensure the highest standards of science education in our schools.

References

Hyland Report (2014). Available at: <https://www.ista.ie/the-hyland-report-2/>

ISTA (2019) *Listening to the Voice of Science Teachers*. Available at: www.ista.ie/jc-science-report/

NCCA (2019) Draft background paper and brief for the review of Leaving Certificate physics, chemistry and biology: <http://tiny.cc/BPaper>