

# Draft Leaving Certificate Biology, Chemistry and Physics syllabi

## *Cause of serious concern for School Leaders*

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### INTRODUCTION

In December 2023 draft specifications\* (syllabi) in Leaving Certificate Biology, Chemistry and Physics were released for consultation by the NCCA. It has been proposed by the Minister that these three new syllabi will be introduced into schools in 2025.

A short period of consultation was allowed and feedback had to be submitted to NCCA by 23 February 2024. The Irish Science Teachers' Association (ISTA) submitted a detailed report to NCCA pointing out some major problems with these draft syllabi. The ISTA report reflected the views of the 648 science teachers who attended CPD events organised by the ISTA and 317 Science teachers who completed a detailed ISTA questionnaire. The ISTA report was written by the Biology, Chemistry and Physics committees of the ISTA and is available online at <https://ista.ie/ista-report-to-ncca-feb-2024> (ISTA 2024). Whilst it is recognised that school leaders are extremely busy people, it is strongly recommended that each school leader should, at least, read the Executive Summary of the report.



SCAN ME



**Figure 1:**

Report submitted by ISTA to the Minister for Education and NCCA

This author represents the Irish Universities Association (IUA) on the NCCA Leaving Certificate Chemistry subject development group. There are two representatives of school leadership on each NCCA subject development group: one representative for the Joint Managerial Body and one for the Association of Community and Comprehensive Schools. This author is not aware of any submission made by these representatives to NCCA on the implications of the three new Leaving Certificate Biology, Chemistry and Physics syllabi for schools. Hence, it is hoped that this article will give an outline of the problems raised by the ISTA and IUA and initiate discussion on the implications of the introduction of the three new syllabi into our second-level schools.

The ISTA report captures the voices of Science teachers in schools throughout Ireland. In addition, the views of teachers were reinforced in an IUA survey of university colleagues in Biology, Chemistry and Physics university departments. This report is available online at <https://www.iua.ie/wp-content/uploads/2024/02/IUA-Report-re-draft-NCCA-LC-Biology-Physics-Chemistry-Specs.pdf> (IUA 2024). Many of the problems highlighted by the ISTA were also highlighted in the IUA report.



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The feedback obtained from secondary school science teachers will now be summarised under various headings and, where relevant, excerpts from the IUA report will also be included. In each case, a small number of direct quotations from teachers will be included to illustrate the type of comments made by teachers. A wider range of more detailed comments may be found in Chapter 7 of the ISTA report.

*\*Note: In this article the term "syllabus" and "specification" will be used interchangeably as the term "syllabus" has great clarity and is the more commonly used term at international level.*

### 1. ALLOCATION OF 40% TO THE RESEARCH INVESTIGATION FOR SCIENCE SUBJECTS IS EXCESSIVE

One of the major problems with the three draft syllabi is the decision by the Minister for Education to allocate 40% of marks to a research investigation or coursework component (referred to as an "additional assessment component") to be carried out by students in sixth year over a period of 20 hours out of the total of 180 hours of class contact time allocated to teach each syllabus. Teachers pointed out that this percentage is far too high for Science subjects and will put enormous pressure on students and teachers.

*As a chemistry teacher with 30 years experience, I am open to any change which is for the good of my students, but this is not it. It will only put more pressure on students who are already overwhelmed with the content of most senior level subjects. It is obvious to most teachers that the current JC programme is not working in terms of the impact of CBA's – talk to students and parents and it is clear it is very stressful and not having a positive impact on their learning. Yet we are about to do the same to our Leaving Cert students. As a teacher and as a mother, I am becoming very disillusioned and disappointed with the new system. Change is necessary but not like this. Someone needs to start listening to the teachers and students on the ground.*

*The proposed time allotment is 180 hours with 20 hours for the additional assessment component research Investigation. 40% being awarded for 11% of the time is completely skewed.*

*40% is much too high a percentage. This will only cause anxiety and stress among students preparing for a high stakes exam.*

The majority of teachers (60%) in the ISTA survey felt that an allocation of 20% to the coursework was their preferred allocation. The second most common allocation (chosen by 29% of teachers) for the additional assessment component was an allocation of 10%.

## 2. ADDITIONAL STRESS ON STUDENTS AND TEACHERS

A common theme running through the responses from teachers was the additional stress and anxiety that will be placed on students and teachers.

*I think the level of stress this will place on students would be immense, particularly since the investigation is overlapping with other practical/oral examinations. Any student who may take more than one Science subject will be overloaded with work and therefore neither subject's assessment will be a true representation of capabilities had more time been afforded. This may lead on to a decrease in selection of more than one science subject due to workload.*

*The new Junior Cycle was a terrible mistake which the Dept just went ahead with while ignoring the genuine concerns of the teaching professionals. I would not like to see this situation arise again where they ignore the professionals in the classrooms to blindly implement this new system. This will put pressure on resources and will add lots of extra work on the class teacher to prep students for the assessment.*

*The line given in the media is these changes are to reduce stress for students whereas introducing all these projects will do the exact opposite ... If students have 3, 4, 5 projects as well as orals and written exams to do, stress levels will sky rocket.*

## 3. LACK OF RESOURCES IN SCHOOL SCIENCE LABORATORIES

The majority of teachers (82%) felt that their school laboratories did not have sufficient resources to support their students in completing the additional assessment component research investigation, Figure 2.

**8. Do you believe that your school laboratories have sufficient resources to support your students in completing to the best of their ability the additional assessment component research Investigation?**

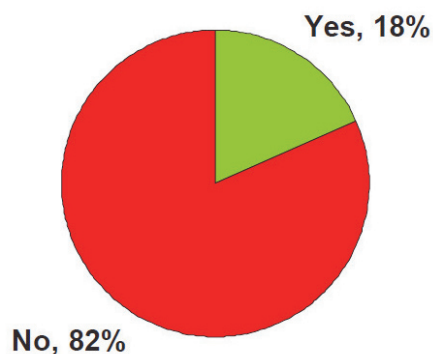


Figure 2:

The majority of teachers do not feel that their school laboratories have sufficient resources to support their students in completing the research investigation. Some typical comments made were:

*We have five labs, currently in 5th year we have 3 biology classes, 2 Agricultural Science classes, 1 chemistry and 1 physics. There is not enough equipment to cover everyone or to fully stock each lab.*

*We will not have enough equipment for the large number of senior Science students in our school, especially if they will be working on individual projects which will tie up equipment. Storage of their project work may also be difficult*

*We are not well equipped enough to have 24 Individual Leaving Certificate Chemistry experiments being carried out at the same time.*

*Students completing a research investigation will also suffer by not having the equipment they need on a regular class basis and this will negatively impact their results.*

## 4. DIFFICULTY OF TIMETABLING ACCESS TO SCHOOL SCIENCE LABORATORIES

Many teachers expressed concern about getting access to school laboratories for carrying out the research investigations and lack of storage areas to leave projects set up. Analysis of the responses highlighted a number of themes emerging, e.g. less practical work having to be carried out at Junior Cycle and Transition Year level, timetabling implications as students will have to be moved out of laboratories to facilitate Leaving Certificate project work, implications of teacher availability for students who wish to participate in BT Young Scientists' Exhibition and the perceived rush to introduce the new specifications in schools in 2025 without schools being adequately equipped.

If all 4 LC Science subjects have individual project components there is no feasible way to facilitate it. We have 2 prep rooms, one is entirely taken over with Ag Science projects. No prep/storage for another 100 projects.

We do not have enough labs for all groups to be in the lab for all periods, especially not at the same time. Currently we run CBA1 during the mock exams as it is the only time we can free up enough labs for 2nd year CBAs. I don't know how we will manage if all 6th year biology and chemistry and physics students are to do six weeks of a practical project at the same time.

Other classes may have to lose out on laboratory times in order for the research part to be carried

## 5. LACK OF LABORATORY TECHNICIAN SUPPORT AND INCREASED WORKLOAD FOR TEACHERS

The lack of laboratory technicians to assist teachers with laboratory organisation and management as well as provide backup support to students undertaking projects was highlighted by many teachers. The huge increase in workload could make the profession of science teaching less attractive and could exacerbate the shortage of science teachers.

We have a dedicated laboratory technician, 4 labs with equipment in each and 2 prep rooms. The equipment is linked to current practical requirements, so any new practicals or practicals students devise for their assessment we will not be equipped for.

No lab technician in a school of 1200 students. We also don't have near adequate equipment for regular equipment never mind any fancy equipment. Really concerned about this.

Impossible to carry out without funding for labs and provision of lab technicians.

The Irish system of teaching without the assistance of a lab technician in a secondary school is totally unacceptable. All these additional projects without technical support will push Science teachers from stretched to burnt out very quickly. We are expected to do two jobs in this role - we need to be allowed to focus on quality teaching, rather than being side-tracked with the work of a technician also.

## 6. HEALTH AND SAFETY CONCERNS

The report of the Irish Universities Association highlighted the Health and Safety implications of the investigative projects model proposed in the draft specifications:

It is clear that considerable funding would have to be provided to schools which are inadequately equipped. In addition, laboratory technicians would have to be appointed to schools – the majority of schools do not have them at present. At third level, in a laboratory of 24 students, it is common practice to have two laboratory tutors present and also the assistance of a laboratory technician. How can one expect a single teacher to manage this huge workload on their own? The Health and Safety implications are considerable and risk assessments need to be carried out for each individual research investigation project. (IUA 2024, p. 28)

The number of students who sat for the Leaving Certificate Physics, Chemistry and Biology examinations in 2023 is summarised in Table 1

Subject	Number of students
Biology	34,602
Chemistry	9,750
Physics	7,526
<b>Total</b>	<b>51,878</b>

Table 1

In addition, 7,460 students sat the Agricultural Science examination. Thus, if the new Biology, Chemistry and Physics syllabi are implemented in 2025, this would mean that approximately 60,000 Leaving Certificate research projects would have to be carried out in school laboratories throughout the country. This will place enormous pressure on students, teachers and school leadership.

Comments from teachers also highlighted their Health and Safety concerns:

I don't see how one teacher can oversee a class of 20-24 students all doing individual projects - if the Dept of Ed want this type of work to be done in schools they can fund lab technicians.

24 students in a class working on different projects with different apparatus - the logistics of managing multiple different experiments simultaneously is an impossible task for the science teacher. This difficulty is already evident in the Junior Cycle CBAs.

How does one teacher supervise 24 individual Chemistry Experiments at one time? Who will prepare the chemicals for the projects (many schools do not have lab technicians) and who will pay for the equipment? In terms of safety again, 4 students at one desk completing 4 different investigations using different chemicals, how can safety be guaranteed?

## 7. WIDENING OF THE SOCIAL DIVIDE

The effect of the research projects on widening the social divide was mentioned by many teachers.

This is going to create a huge divide between children from different backgrounds. It hugely disadvantages students from lower social class backgrounds who will be relying solely on a teacher who is trying to get their heads around the chemistry of 48 projects at the same time. While students with parents who have a background in this will be able to go home and parents will complete the work for them happily. Parents will do anything to increase the amount of points a student gets, even if they don't know the information themselves, they will find (or worse pay for) people who do know the science.

We do not have lab technicians like the private schools

## 8. ADVERSE EFFECT ON UPTAKE OF LEAVING CERTIFICATE BIOLOGY, CHEMISTRY AND PHYSICS

Many teachers predicted that the introduction of lab-based research projects will adversely affect the uptake of the Science subjects.

*I have students who are also studying Design and Communication Graphics, Computer Science, Home Economics, Agricultural Science, PE, all of which include a project element. This will add yet another project to students who are already overloaded with coursework. There are students choosing subjects based on the time commitment required for projects with some attempting to avoid them entirely*

*I also personally think that it will reduce the number of students taking physics for leaving cert as students will reduce the number of science subjects that they take because of the concurrent project load. I think the model of a project and exam reduces the fundamental teaching and therefore learning of the student*

*I think a 40% project will make students less likely to choose science for LC as it's too daunting to take on. If the project was worth 10 or 20%, I feel they would see it as a positive thing.*

## 9. EXPERIENCE OF AGRICULTURAL SCIENCE RESEARCH PROJECTS

Agricultural Science teachers who completed the ISTA survey spoke about the difficulties being encountered by students and teachers in carrying out the project work for Agricultural Science ("Individual Investigative Study").

*As seen in Ag Science, numbers have fallen due to the intensive nature of the IIS. Students are now choosing subjects carefully to manage their time and avoid overload on so called project work ( DCG / Economics / Construction) and not necessarily choosing their favourite subjects. Will numbers studying the Sciences fall?*

*Having been involved with students in the completion of the Agricultural Science IIS I feel the workload on the teacher will increase and that covering this extra module will put a strain on already limited resources.*

*From working with students on their Ag Science projects, it is clear that they struggle massively with the research aspect of the project.*

## 10. RESEARCH INVESTIGATION MODEL IS UNSUITABLE AND IS OPEN TO CHEATING

Unlike the assessment model used in subjects such as languages and music, the model proposed for the Science subjects does not directly assess any laboratory practical skills. Instead, the model simply involves assessing what has been written into a proforma template document that will be forwarded to the SEC. Many teachers commented on the fact that much of the material to be written into this proforma document can be written with the aid of Generative Artificial Intelligence. Recent research presented at the ISTA Annual Conference by Dr Ryan Gallagher and Stephen Murphy provides evidence that this is the case for Leaving Certificate

Agricultural Science and Leaving Certificate Computer Science. University lecturers also made this point in their submission to the NCCA (IUA 2024).

Among the comments made by teachers were:

*The Leaving Cert is a high stakes exam. As an experienced JC examiner, I am very familiar with the difficulty of ensuring that Coursework was indeed the candidate's own work. With developments in AI, this will become an even bigger issue.*

*As a member of the community in which I teach, I would find it very difficult to tackle the issue of plagiarism via AI. That is, it is difficult to prove its use (unlike other forms of plagiarism). I would worry of the potential implications of accusing a student of this sort of plagiarism on my relationships with students and parents.*

*These are not university students. They have not developed adequate research skills to complete this work independently. Little time allocated to help student develop such skills.*

## 11. VAGUENESS OF LEARNING OUTCOMES IN DRAFT SYLLABI

A detailed analysis of all learning outcomes in the three draft syllabi was carried out by the ISTA. The IUA studied the findings of the ISTA and confirmed its agreement with the ISTA. The percentage of learning outcomes that lack clarity is summarised in Table 2 (IUA 2024).

Subject	No. of learning outcomes	No. of learning outcomes that lack clarity	% of learning outcomes that lack clarity
Biology	99	66	66.7%
Chemistry	127	40	31.5%
Physics	101	69	68.3%

Table 2

Unless the lack of clarity in so many learning outcomes is addressed, this problem will increase the stress on teachers and students in preparing for the Leaving Certificate examinations in Biology, Chemistry and Physics.

## 12. LACK OF CLARITY ON MANDATORY LABORATORY PRACTICAL WORK

On average, almost 90% of teachers reported in the ISTA survey that, on reading the draft Biology, Chemistry and Physics specifications, they were unclear on what mandatory laboratory investigations should be carried out by students in school laboratories. An average of 96% of teachers was in favour of a list of mandatory student laboratory investigations being included in the final draft of the Physics, Chemistry and Biology specifications. Details of the mandatory laboratory practical work proposed by ISTA are given in the ISTA report. Unless these details are supplied in the final draft, this problem will add to the stress and anxiety of teachers and pupils as they struggle to understand what laboratory practical work is needed to achieve the relevant learning outcomes.

### 13. IMPORTANCE OF MAKING SCHOOL LEADERS AWARE OF IMPLICATIONS OF THE PROPOSED RESEARCH INVESTIGATIONS IN PHYSICS, CHEMISTRY AND BIOLOGY

Many science teachers pointed out the importance of making school leaders aware of the implications of the proposed research investigations in Physics, Chemistry and Biology

*Principals and school leaders should be required to attend consultations or have formal briefings as to what is changing and the implications for timetabling, refurb work, budgeting and AEN student placement. I know I have highlighted this directly but the tokenistic, hands-off approach of school managers when curricular change is implemented-is simply astounding.*

*Lab work is already diminished due to lack of labs. Curriculum changes need to be implemented with directions to school management and ETB directorate that the business of teaching and learning is the business of schools and appropriate funding and equitable timetabling practises need to be rigorously employed – this ensures some attempt to address rampant inequity of science experience for all students and teachers.*

### SUMMARY AND CONCLUSIONS

It is clear that the introduction of new syllabi in Biology, Chemistry and Physics has major implications for school leaders, teachers and students. The allocation of such a high percentage of 40% to coursework (additional assessment component) involving a laboratory-based research investigation is wholly unsuitable for Leaving Certificate science subjects. This decision is not based on any sound educational principles and will lead to increased stress for teachers and students, place huge pressure on laboratory resources and timetabling of access to school laboratories. In addition, the lack of laboratory technicians in most school will increase the workload of teachers and give rise to serious Health and Safety concerns as teachers struggle to supervise a wide range of laboratory investigations all being carried out at the same time. This could have the effect of making teaching a less attractive profession and exacerbate the current teacher shortage in the science subjects. Health and Safety concerns were also highlighted by university colleagues.

Different levels of support available in DEIS schools and fee-paying schools will widen the social divide. Teachers predict that the research projects will have an adverse effect on the

uptake of Leaving Certificate Biology, Chemistry and Physics due to the increased workload for a high-stakes examination. The negative experience of research investigations in Leaving Certificate Agricultural Science is a forewarning of what could happen in Leaving Certificate Biology, Physics and Chemistry. The readily available Artificial Intelligence software packages means that the model of a research investigation is open to cheating

In addition to the problems outlined above, there is a major problem in the Leaving Certificate Biology, Chemistry and Physics draft specifications due to the vagueness of many of the learning outcomes and the lack of clarity on mandatory laboratory practical work. Teachers also emphasised the importance of making school leadership aware of the problems that will be caused by the introduction of the three new syllabi.

It is hoped that the issues outlined in this article will encourage school leaders to become actively involved in ensuring that the many problems highlighted by ISTA, IUA and other submissions made to NCCA are addressed and rectified prior to the introduction of the three new Leaving Certificate Biology, Chemistry and Physics syllabi. A clear set of recommendations has been made by the ISTA (ISTA 2024) and IUA (IUA 2024) on what needs to be done before the syllabi are introduced into schools.

The following comment made by a teacher summarises the many concerns of teachers very well:

*We need a more specific set of learning outcomes. We need a list of mandatory experiments. We need a reduced % for the project. We need to see samples of projects. We need to see the proposed booklet students would use. We need to see how it will be marked. It is unrealistic to have this unprepared syllabus coming into schools in under two years time.*

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