

Chemical Education in the Republic of Ireland 2015-2016

Peter E. Childs

peter.childs@ul.ie

Summary

The new Junior Science course is due to start in September 2016. This has reduced content (200 versus 240 hours) and no mention of chemical bonding. Six new textbooks for the new course were launched this year but its implementation, featuring more in-school assessment by teachers, is being hindered by opposition from the main second-level teacher's union. They will not cooperate with the new course and members are not allowed to attend in-service courses. This will affect 2/3 of the schools. In addition, the same union is in an industrial dispute with the government that threatens school closures in the coming year. Work is ongoing on new senior cycle science courses to provide more information to teachers on what the specified outcomes actually mean. Science teachers have been unhappy about the level of detail in the new courses. These are due to start in 3 years' time when the new junior cycle science courses have completed their first cycle. It is still an issue as to whether the new junior science course in chemistry will provide an adequate foundation for the existing or new leaving certificate chemistry course. The report of the STEM Review Group is still not published. This year is the last year of the CAO points system for university entry and from next year it will be simplified. Student numbers are increasing in the education system due to an increased birth rate, and this will have major implications for primary, secondary and tertiary levels in provision of new schools and new teachers. (See <http://www.education.ie/en/Publications/Statistics/Key-Statistics/Key-Statistics-2015-2016.pdf> for education statistics.)

Introduction

The main items of interest in the last year in relation to chemical education in Ireland education in general are:

1. Introduction of a new junior cycle science course from September 2016, against a backdrop of opposition from the main secondary teacher's union (ASTI).
2. Increasing numbers in education at all levels due to an increased birth rate in the last decade. See <http://www.education.ie/en/Publications/Statistics/Key-Statistics/Key-Statistics-2015-2016.pdf> for the latest statistics. This will require more investment in new schools and hiring new teachers. Third level has been badly hit with reduced funding, more students, loss of staff and a higher staff:student ratio.
3. In the 2016 there was an increased demand for third-level places, and a continued shift to vocational and STEM-related courses. Nearly 60% of the LC cohort stay on to third level and Ireland has the highest proportion of young people in Europe with third level qualifications.
4. Chemistry at LC level remains the 2nd most popular science after Biology, with a small increase in numbers. Agricultural Science has displaced Physics as the third most popular science. The unusual feature in Ireland is the dominance of Biology. (See Figure 1 below.) Every LC student takes English, Irish and Mathematics and Biology is the most popular optional subject. Science is not compulsory in Ireland at

second level and ~90% take the Junior Science course. The % of the LC cohort in 2016 (55,708) taking each science subject is as follows:

Ag. Science 14.2% Biology 61.2% Chemistry 16.3% Physics 13.9%

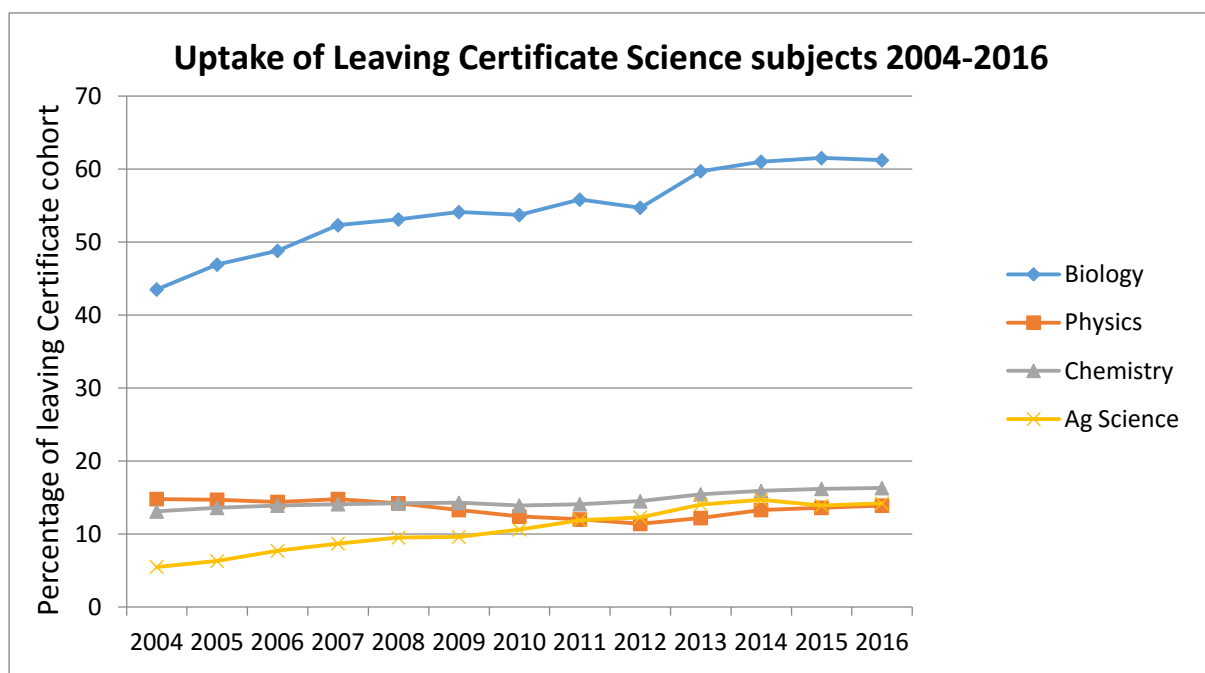


Figure 1: LC Science Statistics 2004-2016

- Ireland's first full Professor STEM Education, Sibel Erduran, is leaving the University of Limerick at the end of 2016 for a professorship at the University of Oxford, having been in Ireland since 2014.

Curriculum developments

a) Junior cycle

The whole junior cycle programme is being revised and the new Science courses starts in 2016. This is a 3 year course. The specification is available at:

<http://curriculumonline.ie/Junior-cycle/Junior-Cycle-Subjects/Science>

New features of this specification include learning outcomes across the unifying strand, **Nature of science**, and the four contextual strands: **Physical world**, **Chemical world**, **Biological world** and **Earth and space**. This is the first time there has been a significant emphasis on the Nature of Science and Earth and Space is a new addition. In April 2016, 6 new textbooks for the new courses were launched. The new course is due to be examined for the first time in 2019.

b) Senior cycle

The existing Chemistry syllabus was introduced in 2000 and is under revision.

(Details can be found at <http://www.curriculumonline.ie/Senior-cycle/Senior-Cycle-Subjects/Chemistry>) A new Chemistry specification has been approved and for the first time it is intended to include assessment of practical work.

(http://ncca.ie/en/Curriculum_and_Assessment/Post-Primary_Education/Senior_Cycle/What-s-New/Science/Scientific-Practices/ChemLC.pdf) (This also applies to the new Physics and Biology courses).

A Science in Practice group has been set up to develop materials for teachers, expanding on the specification, which only includes learning outcomes.

(http://www.ncca.ie/en/Curriculum_and_Assessment/Post-Primary_Education/Senior_Cycle/What-s-New/Science/Science.html)

It would make sense to introduce the new courses at the end of the first cycle of the new junior science course i.e. 2019.

Courses, conferences, workshops

Chemistry teachers in Ireland are well-served by courses, workshops and conferences, in addition to CPD workshops provided by the PDST, the government body responsible for CPD. Special CPD courses for the new junior science course are being provided.

October 2015 – the annual one-day ChemEd-Ireland 2015 was held in University College, Cork. The 2016 conference will be held in Dublin City University, Dublin. This is the only conference specifically for chemistry teachers and it was started in 1982 by Dr Peter Childs.

April 2016 – ISTA weekend conference was held in Limerick in 2016 at Limerick Institute of Technology.

June 2016 – the biannual SMEC research conference was held in Dublin in St. Patrick's College, Drumcondra.

July – 10th Chemistry Demonstration Workshop was run in the University of Limerick and the BASF Summer School featuring Organic Chemistry was run in University College Cork.

July – the Boyle Summer School was run in Lismore, birthplace of Robert Boyle. (www.robertboyle.ie/)

In August 2017 the ESERA conference will be held in Dublin in Dublin City University.

Science teacher publications

Irish science/chemistry teachers have access to a number of publications:

Chemistry in Action! Magazine – 2/3 times a year (free of charge). The Spring 2016 issue (#107) was a special issue on the TEMI FP7 project.

SCIENCE magazine – for ISTA Members, 3 times a year.

Science SPIN – a popular science magazine.

Science Education Research

Considering the size of the country and the science education community, Ireland is very active in science research and has a good international profile. There are science education research groups in Dublin City University (CASTEL), the University of Limerick (EPI*STEM), Dublin Institute of Technology, Trinity College, Dublin and University College Cork. There is a science and maths centre in Waterford Institute of Technology (CALMAST) with a focus on primary maths and science. Ireland has increased its activity in science education research in recent years as evidenced by: research awards (Masters and PhDs), publications, papers given at national and international conferences, and participation in EU projects.

In recent years Irish institutions have been the coordinator (ESTABISH, SAILS) or partners (ENGAGE, FIBONACCI, SALiS, TEMI, ChainReaction, Chemistry is all around us etc.) in European projects and the emphasis on IBSE has had an impact on those Irish teachers and schools involved in the various projects. The Irish Research Council has funded science education research studentships for several years, although these are highly competitive.

Science Teacher Education

There are several routes to becoming a science/chemistry teacher in Ireland:

- The concurrent route – with either a 4 years or 5 years (to Master’s level) duration.
- The consecutive route – post bachelor degree and now 2 years and leading to a Master’s qualification.
- An on-line course based on distance learning.

Two institutions have started to offer a 5 year course leading to a Master’s qualification and there is pressure for all the concurrent courses to move to 5 years, in line with European practice. At present it is possible for a school leaver to be qualified to teach a science subject at second level by following either a 4 year, 5 year or 6 year course, with nominally the same qualification. Government grants for fees only cover 4 years of full-time study.

The Teaching Council of Ireland has changed its requirements for teacher accreditation and several courses have had to be modified to take account of this.

(<http://www.teachingcouncil.ie/en/Publications/Registration/Documents/Curricular-Subject-Requirements-after-January-2017.pdf>). Apart from the broad guidelines, there is considerable

variation in the various courses offered by different institutions in how these are interpreted.

There are very few permanent jobs in teaching and many teachers are on short-term contracts. There is a significant over-supply of science teachers in Ireland and at present there no quotas in place to limit the number of teachers produced. Many new Irish science teachers go abroad to find work.

Science is part of the primary school curriculum from year 1 to year 6 and all primary teachers have courses in science education, although of limited duration.

Informal and non-formal science education

One of the great successes of the Irish system is the focus on non-formal science education through the BT Young Scientists Exhibition, an all-Ireland event, which started in 1963 (<http://btyoungscientist.com/>). The winners of the Irish event have had great success in international competitions.

The SciFest events reach even more students around the country and involve one-day regional fairs and a national fair. This gives every school an opportunity to participate and to encourage science project work in their science teaching. (www.scifest.ie)

Science Week Ireland is an annual event in November (www.science.ie) run by Science Foundation Ireland (SFI). SFI is also responsible for the Discover Science and Engineering Education and Outreach programme (<http://www.sfi.ie/discover-science-engineering-dse/>), with a special emphasis on primary schools.

SFI also sponsors Smart Futures (www.smartfutures.ie/), which encourages STEM personnel in industry to visit schools and talk about their work and career opportunities.

Chemical Education Committees

The RSC Education Division Ireland Region continues to be active and covers the whole island of Ireland, North and South. The RSC has appointed an Education Coordinator for the Republic, based in Trinity College, Dublin, and working with a coordinator and administrator based in N. Ireland. The Spectroscopy in a Suitcase (SIAS) project is being expanded with centres in Dublin, Cork and Limerick/Galway. Postgraduate students visit schools with a kit of spectroscopic instruments, to introduce senior cycle chemistry students to modern spectroscopic techniques. (<http://www.rsc.org/learn-chemistry/resource/res00001239/spectroscopy-in-a-suitcase?cmpid=CMP00002351>)

The Institute of Chemistry of Ireland (ICI) has revived its Education Committee, chaired by Dr Odilla Finlayson (DCU) and ICI is affiliated with EuCheMS, ECTN and IUPAC.

The Irish Association of Science Education Lecturers (IASSEL), which was started in 2000, was revived this year to provide a forum for those involved in science teacher education and science education research. The convenor is Mary Mullaghy (TCD).

Irish Science Teachers Association (ISTA)

The ISTA is an active body representing science teachers with a membership of over 1000. It is a solely voluntary body with no full-time officers. (www.ista.ie) The main activities include:

1. SCIENCE magazine – 3 times a year. (<http://www.ista.ie/publications/science-journal>)
2. An annual weekend conference – in 2016 it was held in Limerick and in 2017 in NUI Maynooth.
3. A national schools science quiz with regional heats and a final in Dublin.
4. Regional monthly branch events around the country.

Institute of Chemistry of Ireland activities

The Institute of Chemistry of Ireland (www.chemistryireland.org) is the professional body for chemists in Ireland. It publishes an electronic magazine (*Irish Chemical News*, <http://www.chemistryireland.org/html/ichemnews.html>) and has an annual Congress, together with a number of specifically education-focused activities. The Institute also works closely with the Royal Society of Chemistry Ireland Region and the Society for Chemical Industry in organising events. ICI is the recognised professional body representing chemists in Ireland and is affiliated with EuCheMS, ECTN and IUPAC.

Some educational activities:

1. Schools Newsletter Competition 2015-2016 was on the theme of 'Chemistry & Light', as 2015 was The International Year of Light.

The 2016-2017 ICI Schools' Chemistry Newsletter competition is now open to all second level students. This year's theme is 'The Chemistry of Climate Change'.

2. The Institute sponsored prizes in the 2015 ISTA Senior Science Quiz.

3. The Institute presented medals to the SIX candidates who tied for top marks in last year's Leaving Cert Chemistry paper (Honours).

4. As is customary, ICI provided a sum of money in sponsorship to the organisers of the Research Colloquium, hosted by UCC: <https://www.ucc.ie/en/chemistry/chemistry->

[colloquium-2016/](#) This is an annual event for chemistry postgraduates to present their research to their peers, which is hosted by each University chemistry Department in turn.

5. The Institute were also pleased to sponsor prizes in the Eurachem Analytical Measurement Competition, which was hosted by Athlone Institute of Technology this year.

6. Finally, the Institute's Education Committee have been working on a response to the new Leaving Certificate Chemistry Syllabus.

Chemical and pharmaceutical industry

Ireland continues to punch above its weight in the biopharmachem sector, which has weathered the recession and provided a valuable backbone for the Irish economy since 2008. There has been a shift to biopharmaceuticals and the industry body is now called Biopharmachem Ireland (<http://www.biopharmachemireland.ie/>) and although international mergers in the industry have resulted in some plant closures, these have been offset by new plants coming on stream. There is a big demand for chemical engineers, chemists and biochemists in the industry.

A report has just been published (8/8/16) on Future skills needs in the Biopharma Industry and forecast 8,400 new jobs in 2020. The industry currently employs 28,200 people (Of these, 21,500 were engaged in Pharma manufacturing and related services, while 6,700 were employed in Biologics) and is responsible for €30.2 billion in exports (2015). (<http://www.skillsireland.ie/Publications/2016/Biopharma-Skills-Report-FINAL-WEB-VERSION.pdf>)

This quotation indicates the importance of the chemical and pharmaceutical industry to Ireland's economic growth. In 2015 Ireland experienced the biggest growth in GDP in the EU.

Of the €89.2 billion goods exported [in 2014], chemicals and related products, which include pharmaceuticals, accounted for 58 per cent or €51.5 billion of the total.

Within this category, exports of medical and pharmaceutical products increased by €973 million (+5 per cent) to €22.2 billion in 2014, as new drug lines began replacing the ones that have come off patent.

(Irish Times 22/5/15 <http://www.irishtimes.com/business/economy/exports-the-primary-driver-of-economic-turnaround-1.2221285>)