



Chemical Society Annual Report to the EuCheMS Division of Chemical Education for 2014-2015

Compiled by Peter E. Childs

1. Abstract

The most important issue in science education in Ireland is the introduction of the new Junior Certificate in Secondary Achievement (JCSA), due to replace the existing Junior Certificate. This was due to be introduced in 2014 with the science courses starting in Sept. 2015. The proposed curriculum involved a major change in assessment, teaching style and content in every subject area. The original proposal was to remove all external certification and have 100% teacher-based assessment. The teachers' unions rejected this as they did not want to be responsible for the certification of their own students and wanted the externally moderated examinations retained. They went on strike during 2014-15 and the compromise proposal shifted to 60% external and 40% school-based assessment. This was also rejected by the teachers and a final compromise proposal with no school-based assessment for certification is due to be voted on in September 2015. The introduction of the science specification has been deferred to 2016. A consultation on the new specification was held in October 2014 and the theme of Materials was renamed The Chemical World, to more clearly identify the chemistry content. The revised leaving certificate subjects in Chemistry, Physics and Biology are not due to be introduced until 2018 and their content and approach is still controversial.

The Royal Society of Chemistry has expanded its remit in Ireland with the appointment of a Programme Manager in Belfast and two Education Coordinators, one based in QUB and one in TCD.¹ The Education Coordinator in N. Ireland was appointed in Autumn 2014 and the one in the Republic is being appointed at present.

¹ Third level institutions mentioned: DCU Dublin City University; DIT – Dublin Institute of Technology; LIT Limerick Institute of Technology; NUIG – National University of Ireland Galway; NUIM – National University of Ireland Maynooth; QUB – Queen's University Belfast; RCSI – Royal College of Surgeons of Ireland; TCD – Trinity College Dublin; UCC – University College Cork; UCD – University College Dublin; UL – University of Limerick; WIT – Waterford Institute of Technology

2. National educational policy

The most important issue in science education in Ireland at present is the introduction of the new Junior Certificate in Secondary Achievement (JCSA), due to replace the existing Junior Certificate from 2014 onwards. (See NCCA, <http://www.juniorycycle.ie/>)



Figure 1 The new junior cycle skills

The new curriculum is based around a series of skills (Figure 1 and was due to be introduced in 2014 (starting with English), with the science course starting in Sept. 2015. The science specification was reduced to 200 hours (from the present 240 hours). The course consists of an overarching strand of Nature of Science applied to 4 content-based strands: The Physical World; the Biological World; The Chemical World (formerly Materials); Earth and Space. Each strand has 4 elements: Building Blocks and Key Ideas; Systems and Structures; Energy; Stewardship and Citizenship. The application of these is illustrated in Table 1, which shows The Chemical World strand. This strand has been criticised for the omission of bonding, as for many students this will be their first and last experience of chemistry. The detailed content of the specification is not given, although examples of the assessment have been given in the draft specification. Following publication of the draft specification a public consultation was held in October 2014. The draft science specification and results of the consultation in October 2014 can be accessed at <http://www.juniorycycle.ie/Curriculum/Subjects/Science/Science>.

Table 1 The JCSA The Chemical World strand (formerly Materials)

Elements	Strand three: Materials
	Learning outcomes Students should be able to
Building blocks	<ol style="list-style-type: none"> 1. Investigate whether mass is unchanged when chemical and physical changes take place 2. develop and use models to describe the atomic theory of matter; demonstrate how they provide a simple way to account for the conservation of mass, changes of state, physical change, chemical change, mixtures, and their separation 3. describe and model the structure of the atom in terms of the nucleus, protons, neutrons and electrons; comparing mass and charge of protons neutrons and electrons 4. classify substances as elements, compounds, mixtures, metals, non-metals, solids, liquids, gases and solutions
Systems and Interactions	<ol style="list-style-type: none"> 5. use the Periodic Table to predict the ratio of atoms in compounds of two elements 6. Investigate the properties of different materials including solubilities, conductivity, melting points and boiling points 7. Investigate the effect of a number of variables on the rate of chemical reactions including the production of common gases and biochemical reactions 8. Investigate reactions between acids and bases; use indicators and pH scale
Energy	<ol style="list-style-type: none"> 9. consider chemical reactions in terms of energy, using the terms exothermic, endothermic and activation energy, and use simple energy profile diagrams to illustrate energy changes
Sustainability	<ol style="list-style-type: none"> 10. evaluate how humans contribute to sustainability through the extraction, use, disposal, and recycling of materials.*

The original proposal was to remove all external certification and have 100% teacher-based assessment. The teachers' unions rejected this as they did not want to be responsible for the certification of their own students and wanted the externally moderated examinations retained. They went on strike 3 times during 2014-15 and a compromise proposal shifted to 60% external and 40% school-based assessment. This was also rejected by the teachers and a final compromise proposal with no school-based assessment for certification is due to be voted on in September 2015. The introduction of the science specification has been deferred to 2016. A consultation on the new specification was held in October 2014 and the theme of Materials was renamed The Chemical World, to more clearly identify the chemistry content. The revised Leaving Certificate (LC) subjects in Chemistry, Physics and Biology are not due to be introduced until 2018 and their content and approach is still controversial. The body responsible for syllabus and curriculum development (the National Council for Curriculum and Assessment, NCCA), proposed a draft chemistry syllabus consisting only of learning outcomes. This was criticised by the ISTA Chemistry Committee and their views were not listened to. In April 2014 they commissioned a report from an educational expert (The Hyland Report, <http://www.ista.ie/news/hyland-report-0>), which criticised the new syllabus by comparison to international norms. The NCCA seems to have ignored the comments from the ISTA and other bodies with concerns about the new syllabus.

The transition from the new JCSA science course to the LC science courses is a major issue as the LC science courses were revised before the junior science course, and the gap in level and content between junior and senior cycles appears to be greater than at present.

There has been a complete revision of mathematics at junior and senior cycles and all students now take the problem-based Project Maths course. This has resulted in an increase in the numbers taking higher level (HL) leaving certificate mathematics, however, at the same time the syllabus was changed, bonus points were introduced for taking HL mathematics. There has been criticism of the content of the new course and its suitability as a preparation for advanced studies in science and engineering. Essentially every student in Ireland (>95%) continues to study mathematics to the end of schooling.

Chemistry continues to be the second most popular LC science subject (~15%), but trails far behind biology (~55%); agricultural science has now overtaken physics as the third most popular science subject. Applications for science degree courses (level 8) has remained strong.

The Teaching Council revised its rules for registration of teachers and this has meant that teacher education courses in science have had to be revised. The postgraduate, consecutive teaching education course (Professional Diploma in Education) was increased from 1 to 2 years in September 2014, on top of a 3 or 4 year undergraduate degree. The concurrent teacher education courses are mostly 4 years, but two institutions (UCD and NUIM) have moved to a 5 year course, which is a master's level award. This is in line with the common 2+2 European model of teacher education.

At postgraduate level in science many institutions have moved to a 4 year structure PhD model, although the 3 year research model is still offered.

A national STEM Review Report was commissioned in 2013 and was due to report in summer 2014; the report has been finished and is awaiting release.

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3. Events in chemical education

a) Conferences for teachers:

June 2014/ June 2015 Robert Boyle Summer School (Lismore, Waterford, WIT)
www.robertboyle.ie/robert-boyle-summer-school
 October 2014, ChemEd-Ireland (Dublin, DIT)
 March 2015, ISTA AGM (Cork, UCC)

b) Workshops/courses for teachers:

June 2015 9th Chemistry Demonstration Workshop (Limerick, UL)
 June 2015 BASF Summer School for Teachers (Cork, UCC)
 June 2015 Innovation in Medicines Residential Workshop (Limerick, UL)

c) Science fairs for students:

October 2014 Mallow Maths and Science Fair
 Nov. 2015 Science Week Ireland (www.science.ie/)
 Jan. 2015 BT Young Scientist and Technology Exhibition (Dublin)
 (www.btyoungscientist.ie/)
 April-May 2005 SciFest fairs (<http://scifest.ie/>)

4. Activities of the Institute of Chemistry of Ireland

Sept. 18-19th 2014 ICI Congress (Limerick, LIT)
 Theme - ‘Culturing of Crystal, Chemical & Biochemical Solutions’.
 April 30th 2015 ICI Congress (UCD)
 Theme – “Modern Approaches to Asymmetric Synthesis”.

Annual ICI Chemistry Award (Eva Philbin Lecture Series)

Recipient Prof. Thorfinnur Gunnlaugsson (TCD)
 “Self-assembly Supramolecular Structures & Material made from Novel Acrylic Ligands” at RSCI (Dec.2014), NUIG (April 2015 & QUB (May 2015).

Boyle-Higgins Award 2015:

Professor Dermot Diamond (DCU) delivered his lecture entitled “Chemical Sensing with Autonomous Devices in Remote Locations” April 16th at DCU.
 June 2015 67th Irish Universities Chemistry Research Colloquium at NUIM

5. Publications

A number of publications in Ireland are aimed at chemistry/science teachers (*Chemistry in Action!*, *Science*), professional chemists (*Irish Chemical News*) and the general public (*Science Spin*).

6. Liaison with the chemical industry

The following training workshops (Table 2) have been run with/for industry through the Synthesis and Solid State Pharmaceutical Centre based in the University of Limerick, a good example of successful collaboration between academia and industry.

Table 2 Some industry-academia collaborations run by SSPC (UL)

Date	Event	Audience
June 2014	SSPC/UL/NUIG/Roche Masterclass in Process Development and Scale-up	Fourth-level students
August 2014	SFI SMART FUTURES Training	Third-level students
September 2014	Training: Masterclass in Synthetic Organic Chemistry	Industry & Fourth-level students
December 2014	Training: Dynochem for SSPC Chemists	Fourth-level students
January 2015	Training: CCDC Workshop for SSPC Researchers	Fourth-level students & academics
January 2015	Polymorphism in Pharmaceutical Solids	Industry
June 2015	Chemometrics	Industry & Academics
June 2015	PAT Conference	Industry and academics
August 2015	Drug Product Formulation	Industry

Pharmaceutical Ireland (www.pharmaceuticalireland.ie/) has an education officer and works closely with the ISTA to fund the Science Teacher of the Year award and the National Senior Science Quiz. Pharmaceutical Ireland also supports the Chemistry Demonstration Workshop in UL. *Chemistry in Action!* magazine has been funded since 1980 by donations from a number of Irish chemical industries.

7. International and European initiatives

Ireland continues to be involved with several European projects in science education, most of them with a chemical component. The FP7 Science and Society projects include: ESTABLISH (2010-2014) – DCU; SAiS – DCU; PROFILES – UCC (finishing 2015); TEMI – UL (finishing 2016); Chain Reaction – UL (finishing 2016).

8. Other events and activities

Two Spectroscopy in a Suitcase kits, sponsored by the Royal Society of Chemistry, have been located in the Republic of Ireland in TCD and UCC, as an outreach activity in schools (see <http://www.ucc.ie/en/chemistry/outreach/sias/>).

Trinity College Dublin (TCD) has an active outreach programme and hosts a Salters Festival of Chemistry and runs Summer Schools for students (<http://chemistry.tcd.ie/outreach/summer-school/>). An interesting activity for undergraduates is the Broad Curriculum event at which a series of shortlisted presentations, written by SF (second year) undergraduates, are presented to a packed

audience of over 300 students and friends. The talks are designed to relate chemistry to the world around us, and are performed in a fun/educational way. TCD won the competition to host the new RSC Education Coordinator for the Republic of Ireland. University College Cork also has an active outreach programme (<http://www.ucc.ie/en/chemistry/outreach/>). University College Dublin (UCD) has an active outreach programme which includes a summer course for students on green chemistry. (<http://www.ucd.ie/chem/outreach/>)

9. Name of delegate

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10. Contact details of delegate.

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Acknowledgements: the help of Margaret Franklin (ICI), Sarah Hayes (SSPC/UL), Mary Mullaly (ISTA) is acknowledged in compiling this report.