



## Teacher Training in Science: Ireland

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### Abstract

*Teachers are seen as key actors in motivating students to appreciate and study Science Technology Engineering and Mathematics (STEM) subjects, including Chemistry subjects. Teacher training in Science Education is an important factor in the development of motivated and motivational educators. Science education at second level in Ireland is in a state of chassis: A proposed revamp of the junior secondary school curriculum, in which Chemistry is taught as part of an integrated Science subject, is underway. A proposed new curriculum for senior second level Chemistry, with a more emphatic requirement for practical work, is currently in the post-consultation phase. A new Chief Examiner for Chemistry at secondary level has recently been appointed. All this reform comes at a time when uptake of Chemistry as a subject for the terminal examination at second level in Ireland, the Leaving Certificate, has seen a slight increase to over fourteen per cent. However, this turnaround could be difficult to maintain due to a number of factors, including the fiscal situation and its effect on school budgets for more expensive practical subjects, as well as allocation of subjects within timetabling constraints and choice by students of the science and technology subjects. Teachers and school facilities have a central role to play in attracting students to study Chemistry. Just as the curricula are in the midst of a state of reform, likewise the system and requirements for initial teacher education is undergoing a number of changes. This paper will present a review of the current status in Ireland for training teachers of Science and Chemistry. It will also review the opportunities and supports for Continuous Professional Development.*

### 1. Introduction

In Ireland, initial teacher education programmes for primary and secondary teachers are facilitated through a range of concurrent (undergraduate) and consecutive (postgraduate) programmes. Currently there are 19 state-funded providers of Initial Teacher Education (and 3 non state-funded) offering more than 40 college programmes in primary and post-primary (secondary) teaching.

There are five state-funded Colleges of Education which offer programmes of teacher education for primary teachers through a concurrent (undergraduate) programme leading to a Bachelor of Education (B.Ed.) degree. Four of the colleges offer a Graduate Diploma in Education (GDE). The latter is also offered by a private college as an online, blended course. Currently, undergraduate programmes for primary teachers are three years in duration, although this has been extended to four years, with effect from September 2012. Post-graduate programmes for primary teaching are currently offered over 18 months, and this will be extended to two years with effect from September 2014.

For secondary teachers, the concurrent route to a teaching qualification is offered for a wide range of programmes, typically those with practical, laboratory and workshop elements. The secondary consecutive route is via the postgraduate Diploma in Education (PDE). Entry requirements include a degree in at least one subject which meets the criteria for registration with The Teaching Council. [1] Currently, PDE programmes are one year in duration, although this will be extended to two years from September 2014.

All teacher education programmes in Ireland that lead to registration must have professional accreditation from the Teaching Council. The colleges and their concurrent and consecutive routes





that are relevant to training in Science or Chemistry education are summarised in the tables which follow.

College	Qualification
Mary Immaculate College, Limerick	Bachelor of Education
Froebel College of Education / NUIM	Bachelor of Education
Colaiste Mhuire, Marino	Bachelor of Education
Church of Ireland College of Education	Bachelor of Education
St. Patrick's College, Drumcondra	Bachelor of Education

**Table 1: Colleges offering concurrent teacher training at Primary level**

College	Qualification
St. Patrick's College, Drumcondra	Graduate Diploma in Education
Froebel College of Education	Higher Diploma in Education
Hibernia College	H.Dip in Arts in Primary Education
Colaiste Mhuire, Marino	Higher Diploma in Education
Mary Immaculate College, Limerick	Graduate Diploma in Education
St. Patrick's College, Drumcondra	Graduate Diploma in Education

**Table 2: Colleges offering consecutive teacher training at Primary level**

As far as the primary training is concerned, all pre-service teachers must have some training in science to enable them connect with the science curriculum at primary level.

Just as with the primary level, there are both concurrent and consecutive routes to qualifying as a science teacher for secondary level.





College	Qualification
University College Cork	Bachelor of Science in Education
National University of Ireland, Maynooth	BSc. In Science Education
Dublin City University	BSc. In Science Education
Dublin City University	Physical Education with Biology
University of Limerick	BSc.Ed. in Physics and Chemistry
University of Limerick	BSc.Ed. (Biological Science with Chemistry or Physics)
St. Angela's College	Bachelor of Education (Home Economics with Biology)

**Table 3: Colleges offering concurrent Science teacher training at Secondary level**

College	Qualification
University College, Dublin	Postgraduate Diploma in Education
University College, Cork	Postgraduate Diploma in Education
National University of Ireland, Galway	Postgraduate Diploma in Education
National University of Ireland, Galway	Postgraduate Diploma in Education Irish
National University of Ireland, Maynooth	Postgraduate Diploma in Education
Trinity College, Dublin	Postgraduate Diploma in Education

**Table 4: Colleges offering consecutive Science teacher training at Secondary level**

## 2. Pre-service training in Primary School Science

In September 2012 the Minister for Education announced plans for a radical overhaul and rationalisation of pre-service training provision. [2] Minister Quinn accepted the recommendations set out in a report commissioned by the Higher Education Authority (HEA) on the structures of teacher training. The purpose of the report, requested by the Minister, was to identify possible new



structures to improve teacher education in Ireland so that it is comparable with the best in the world. Thus we are in a state of transition.

## 2.1 Pre-service training in Primary School Science

Chemistry is embedded in the Primary curriculum in the *Materials* and *Environmental Awareness and Care* strands of Social Environmental and Scientific Education (SESE), which was formally introduced in 2003/4. [3]

The National Council for Curriculum and Assessment (NCCA) [4] have advocated Science as being an important addition to a child-centred curriculum: *'As well as helping children to become scientifically literate members of society, the curriculum aims to foster positive attitudes to science and to encourage pupils to develop an appreciation of the contribution of science and technology to society'*.

For many older teachers the connection with science would traditionally have been through 'nature studies'. However, the aim of the SESE curriculum was to make the Science more dynamic, interactive and scientific. *'An experimental and investigatory approach to science in the primary school can make a unique and vital contribution to the holistic development and education of the child... at the same time developing and using scientific ways of investigating and exploring the world'*. Teacher training must give the teacher confidence to deal with topics which would perhaps have been outside the 'comfort zone' of the older teaching cohort. The NCCA gives comprehensive guidance for teaching the Science streams, an invaluable aid for in-service teachers. Meanwhile the primary teacher training programmes have embedded Science teaching studies in their curricula, as summarised in Table 5.

College	Course Years	Modules
Mary Immaculate College, Limerick	1 3	STeM 3: Introduction to Science STeM 6: Teaching Maths and Science
Froebel College of Education / NUIM	1 2	Mathematical & Scientific Enquiry
Colaiste Mhuire, Marino	1	Social Environmental and Scientific Education
Church of Ireland College of Education	1	Social Environmental and Scientific Education
St. Patrick's College, Drumcondra	1	Biology and science education (optional)

**Table 5: Sample of Science-related modules offered to pre-service primary teachers**

The modules listed are typically one semester in length and give the pre-service teachers experience of practical aspects of the Science curriculum.

## 2.2 Pre-service training in Secondary School Science/Chemistry

Science at lower secondary level is currently presented as a single Junior Certificate subject with three distinct sections, one of which is Chemistry. Teachers qualified to deliver upper secondary courses in Chemistry, Physics or Biology typically would also teach the integrated Science at junior secondary level. For logistical and resource reasons the reality is that a science teacher may be expected to deliver the whole Junior Certificate syllabus, not just those sections for which they are fully qualified. In other words, the Chemistry may be taught by a teacher who is primarily a Physicist or Biologist. The Junior Certificate Science curriculum guidelines [5] offer suggestions for classroom practice that can facilitate students in developing their knowledge, understanding, skills and attitudes in relation to science. However, they advise that *'teachers should choose an appropriate teaching methodology for the achievement of the aims, objectives and learning outcomes specified in the syllabus'*. The support of the Junior Certificate Science Support Service [6] has been invaluable in aiding teachers dealing with subjects outside their specialities. The aims of the service include, assisting teachers to work together effectively in school, assisting non-subject specialists, and helping teachers to integrate ICT in science teaching and learning. Anecdotal evidence suggests that uptake of Science subjects at senior cycle can be very much influenced by the teacher at junior cycle.

Transition Year is an optional year between ISCED 2 and ISCED 3, which is generally taken by just under fifty per cent of all students, and where students get a 'taster' of various subjects. Science delivered in this year is usually in the form of short modules with attractive titles, e.g. Cosmetic Science and Forensic Science. Few teachers have laboratory time for all of their science classes during Transition Year. [7] This compounds the problem which may arise in junior cycle where teachers are non-specialists for some parts of the integrated Science syllabus, in so far as they may offer 'taster' modules that lean towards their own subject specialities.

## 2.3 Pre-service training in Secondary School Chemistry

Science graduates going into teaching have traditionally been sought after, and have had a strong chance of securing full-time employment. Science is a subject that is constantly changing and evolving. If teachers are unable to appreciate and adapt to this, their students may be left with an unrealistic view and understanding of the value and use of science in our everyday lives. [8]

Leaving Certificate Chemistry is offered at two levels, Ordinary (OL) and Higher (HL), which creates a difficulty in classroom management as both levels are typically taught in the same classes. In addition some schools have been under-resourced with regard to technical support and equipment issues. Not all science classes are taught in laboratory settings. However, as Showalter said 'if you have a well-stocked laboratory but a poorly trained teacher' pupils will not benefit. [9]

As shown in tables 4 and 5 Ireland has both concurrent and consecutive models of secondary science teacher training. Whichever mode is employed, the development of adequate subject matter knowledge in pre-service teachers is imperative. A number of studies have shown that teachers who have misconceptions about chemical concepts pass these on to their pupils. [10,11] There have always been question marks about the efficacy of the concurrent model in linking pedagogical and content knowledge, with some calls to phase out the model entirely.

The Teaching Council is responsible for reviewing and accrediting programmes of teacher education and training provided by Higher Education Institutions (HEIs) in Ireland. The Council's professional accreditation function is distinct from the process of academic accreditation which programmes already undergo. Academic accreditation is based on the suitability of a programme for the award of a degree/diploma; whereas professional accreditation is a judgement as to whether a programme prepares one for entry into that profession. In 2009, the Council began reviewing programmes, including the concurrent programmes and recommendations were made specifically in relation to



subject content in balance with pedagogical content. All review reports have been published on the Teaching Council website.

### **3. Probation and Induction**

In order to gain full registration as a Post-Primary teacher, all teachers must complete a period of Post-Qualification Employment (PQE). This involves providing evidence of 300 hours' teaching experience in a recognised school which is verified and signed by the school principal. A minimum of 200 hours of the approved teaching experience must relate to the teaching of a recognised curricular subject to a class of at least 14 students. Up to 100 hours of the approved teaching experience may be carried out in a learning support, special needs, language support, or guidance counselling role. A maximum period of three years is permitted to meet this requirement. This is moderated by the Teaching Council.

The National Induction Programme for Teachers (NIPT) consists of 12 workshops, which take place in the late afternoon or evening time for two hours each. They take place in education centres and/or outreach venues around the country. Newly Qualified Teachers will be required to attend all workshops within three years of their date of registration. Once all the workshops have been completed, the Education Centre Network will provide participants with a Certificate of Attendance and notify the Council of same. The condition will then be removed and the teacher's registration status will be updated on the Register of Teachers.

## **4. In-service Training and Supports for Science/Chemistry Teaching**

### **4.1 Continuous Professional Development**

Science teaching is such a complex, dynamic profession that it is difficult for a teacher to stay up-to-date. For a teacher to grow professionally and become better as a teacher of science, a special, continuous effort is required. [9]

Chemistry teachers have been excellently supported for some time by the Second Level Support Service (SLSS), which is now under the umbrella of The Professional Development Service for Teachers (PDST).[12,13] This offers induction and continuous development training at a local and national level. For example, the PDST Chemistry trainers are offering courses this Spring in Chemistry for non-specialists, Hands-on science enquiry activities, Science-based enquiry through computational thinking, Schoology workshops where participants will also receive the annual PDST DVD of resources for chemistry teaching.

### **4.2 Other supports for professional development**

There is a community of practitioners in Ireland who are providing excellent support to science teaching in general or chemistry teaching in particular. Young teachers are encouraged to access these facilities which are outside the realm of formal CPD but which are available for career-long support. They include:

The Irish Science Teachers Association (ISTA) [14] is the Subject Association for teachers of Science in the Republic of Ireland, with over 1,200 members. Branches hold frequent meetings of interest to Science teachers, and the Association has had representation on the various syllabus committees which drew up the revised programmes in the various Science subjects. The Association has several Sub-Committees which do valuable work in the various subject areas. The ISTA holds an AGM in the spring of each year with a very broad programme of interest to people in different areas of Science education. Trainee teachers are included in membership and all activities of the ISTA.





The National Centre for Excellence in Maths and Science Teaching & Learning (NCE-MSTL) [15] The mission of the NCE-MSTL is to address issues in the teaching and learning in science and mathematics

by conducting best practice, high level evidence-based research into teaching and learning in mathematics and science - incorporating all learning environments - formal, non-formal and informal. It is collaborating and sharing information with all universities and institutes in order to formulate strategies that enhance mathematics and science teaching and learning from primary school, through secondary school to third level and fourth level. In addition it aims to translate existing research into effective best practice in mathematics and science teaching and learning, and to achieve this through designing, informing, advising and delivering nationally recognised evidence based CPD programmes. It currently has a cohort of postgraduate researchers, many of whom are carrying out research relevant to modifying and enhancing teacher training.

The ChemEd-Ireland annual conference [1] is an annual conference held to provide an opportunity to share ideas and resources relevant to teaching chemistry and science in Ireland. It is attended by both pre-service and in-service teachers.

The importance of training primary teachers in science has been recognised by the training colleges. Extra support is available through the Discover Primary Science and Maths Programme (DPSM) which is the national programme to foster interest in science, technology engineering and maths among children in primary schools. Participating schools carry out a range of science and maths activities in the classroom and are also encouraged to undertake additional explorative activities and projects. [17] Teachers can attend a whole school hands-on induction afternoon, where they learn about undertaking science and maths activities in the classroom. They can also avail of excellent web-based support.

In conclusion, Irish teacher training institutions and courses are in a state of review and reform. The debate about the effectiveness of concurrent versus consecutive training continues. Training institutions are also being encouraged to carry out more research to inform their practices. In the words of the Sahlberg Report to the Higher Education Authority in July 2012: 'We believe that in order to advance further in its national teacher education system, Ireland needs to invest more in the continuous improvement of the quality of teaching, the role of research in teacher education, and international cooperation in all of its teacher education institutions'. [18] The report adds that the review panel 'reiterates that the key characteristics of internationally recognised teacher education systems include high quality instruction on both pedagogy and pedagogical content knowledge, a strong focus on research as a basis of teaching and learning, a close and systematic engagement with schools...'. There are interesting times ahead.

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