

Senior cycle science consultation



Irish Business and
Employers Confederation



Submission to the National Council for Curriculum and Assessment

December 2011

Irish Business and Employers Confederation (IBEC)

IBEC is the national voice of business and employers and is the umbrella body for Ireland's leading sector groups and associations. IBEC represents the interests of business in Ireland and provides a wide range of direct services to its 7,500 members, which range from the very small to the largest enterprises, employing over 70% of the private sector workforce in Ireland.

Pharmachem Ireland

PharmaChemical Ireland is a sector within IBEC representing the chemical and pharmaceutical industry in Ireland. Its member companies research, develop and manufacture pharmaceutical products, ingredients and general chemical material. PharmaChemical Ireland represents their views to the government, relevant state agencies, local authorities and the public. The association is committed to providing a receptive environment for a strong and progressive industry in Ireland and is active in the area of science education.

Preamble

IBEC and Pharmachem Ireland welcome the opportunity to comment on the draft senior cycle syllabuses. We also wish to commend the NCCA's engaging and highly informative consultation resource material.

Ireland's education system played a key role in our economic transformation over the last three decades. At this extremely challenging time, the system is being called upon again to innovate and change in several fundamental ways, if we are to meet new demands coming from the workforce, employers and society. This is the context in which review of the senior cycle subjects should be considered.

Ireland is known as a world leader in the manufacturing of biopharma-pharmachem products, attracting some of the world's leading pharmaceutical companies, and is also home to a thriving domestic sector. Eight of the top ten global pharmaceutical companies are located in Ireland, with seven of the top ten pharmaceutical blockbusters produced here. Ireland is also emerging as a leading location for biopharmaceuticals with a mix of start-ups, high growth SMEs and large multinationals located here.

Industry leaders including Pfizer, Eli Lilly, Genzyme, Merck, Elan, GeneMedix and Allergan have significant investment in Ireland, which has facilitated rapid growth and development of the biopharma industry. While foreign-owned companies account for 86% of employment in the sector, there has been rapid growth in employment in indigenous companies. Ireland also provides a world class research landscape, a cluster of pharmaceutical, biopharmaceutical, medical device and

diagnostic companies whose reputation is based upon knowledge, flexibility and the ability to deliver. It should also be remembered that the demand for the 'laboratory sciences' is not confined to the biopharma-pharmaceutical sector. Leading ICT companies such as Intel continue to create significant demand for chemical engineers and physicists.

The challenge for the Irish industry now is to retain its hard-earned size, scale and reputation by continuing to deliver world-class performance in all aspects of current operations. An appropriately skilled workforce will be an important ingredient to meet that challenge. Unfortunately in sharp contrast to this strengthening of demand in the labour market, there has in over the last two decades been a decline of interest in science throughout the Irish education system.

- Between 1990 and 2010, the participation rate in leaving certificate physics has declined from 20% to 12% and in chemistry has fallen from 16% to 14%.
- Biology was the only science subject in the top-ten most popular leaving certificate subjects in 2010; chemistry and physics were ranked 13th and 15th respectively.
- Under 17% of Leaving Certificate students sat at least two core science subjects in 2010

Clearly, the secondary education system fulfils a vital role in society that extends well beyond that of satisfying enterprise's needs for skills or research. By the end of the secondary education, students should also have sufficient knowledge of science to engage in public discussions on science-related issues, to be critical consumers of scientific information related to their everyday lives, and to be able to continue to learn about science throughout their lives. And these are goals for all of Ireland's students, not just those who pursue higher education or careers in science, engineering or technology.

The Draft Syllabuses

IBEC and PharmaChemical Ireland do not propose to comment in detail on the draft syllabuses. This is the domain of the educationalists. However, consultations with practitioners in our member companies have prompted an extremely positive response to the NCCA's proposals. The following aspects are particularly welcome:

Emphasis on enquiry based teaching and learning

The core skills of investigation and problem solving are important skills required by industry and it is important that these are developed at second level. According to the European Commission¹, most studies have also found positive impacts of inquiry instruction on student content, learning and

¹ Science Education in Europe: National Policies, Practice and Research, Eurydice, Oct 2011. Page 70

retention. Overall, results indicated that ‘having students actively think about and participate in the investigative process increases their science conceptual learning.’

However, we would prefer to see the specific outcomes of the experiments removed from the curriculum in order to enhance the investigative process. This will strengthen the key skills and provide for more relevant and flexible learning in science, an element that is missing in the present syllabus. Science graduates of organic chemistry are the backbone of the pharmaceutical industry. Therefore we would prefer to see more emphasis on learning the fundamental principles. Students should not be encouraged to just memorise the chemical names; instead emphasis should be placed on the basic understanding of the principal rules of organic chemistry.

Second mode of assessment

The introduction of the proposed second mode of assessment is particularly welcome. Science is a practical subject. Therefore such an assessment is more fruitful than students being graded solely on a terminal examination. As the NCCA itself points out, practical activities develop procedural understanding in students – understanding of concepts such as data collection, reliability and validity, measurement and uncertainty, and the ability to interpret evidence.

We would like to propose that the second mode of assessment could be piloted in chemistry or physics before being rolled out in all three subjects. This will allow for a more in-depth analysis of the implementation and allow potential issues such as availability of appropriate resources and access to laboratories to be resolved with a smaller cohort of students.

Increased attention to context, careers and latest scientific developments

In order to increase motivation and interest in science, it is essential that the new curriculum emphasises connections with students’ personal experiences, potential careers and their awareness of the latest scientific developments through the media. Industry has an important role to play in this regard. The more abstract issues relating to scientific method, the ‘nature of science’ or the production of scientific knowledge cannot be ignored at this more advanced level. However most advanced education systems are making efforts to integrate context-based issues and hands-on activities into science curricula.

Enjoyment of learning science.

Overall, the proposed syllabuses have the potential to enhance the enjoyment of learning science. International student achievement studies demonstrate a clear link between enjoyment of learning science and science achievement. PISA 2006 showed that students’ belief in whether they could handle tasks effectively and overcome difficulties (self-efficacy in science) was particularly closely

related to performance. The results suggest that students with greater interest in science are more willing to invest the effort needed to do well²

Resources

The single greatest obstacle to reform is likely to be resources in a severely constrained environment. However while this reality should be acknowledged, it should not be permitted to undermine a project that has critical implications for Ireland's future economic development. All stakeholders should approach the challenge with a positive attitude and a focus on solutions.

ICT tools can improve, extend and support learning and help evaluate learning outcomes under the proposed curriculum. These tools will also allow for the assessment of learning outcomes and thereby enable a more flexible and effective process. It is critical that the significant resources that have been allocated to the ICT in the classroom initiative (Smart Schools = Smart Economy) are effectively leveraged to drive the curriculum reform.

The expertise, resources and goodwill that exist in industry to improvement in science teaching and learning should also fully utilised to support the curriculum reform programme. IBEC recommends that NCCA sets up a working group, drawn from industry, science teachers and third level specialists, to make specific recommendations around a cost-effective, realistic and sustainable resource allocation strategy that will help underpin the curriculum reform programme

Teacher science education

Several international studies in Europe and the US have highlighted the importance of strengthening teacher competences and the complexities of moving teaching from traditional methods to those which are enquiry-based should be acknowledged as a challenge. Recent research cited by the European Commission³ and the new US Framework for K-12 Science Education have affirmed what was already known about effective teaching methods and have also found new directions. For example, teachers' professional development combined with in-school evaluation and co-teaching have shown positive results for the schools and teachers using these methods.

Countries which have a strategic framework for the promotion of science education and curriculum reform normally include the improvement of science teacher education as one of their objectives. School partnerships, science centres and similar institutions all contribute to teachers' informal learning and may give valuable advice. Science centres in several countries also provide specific

² OECD, 2007. PISA 2006: science competencies for tomorrow's world

³ Science Education in Europe: National Policies, Practice and Research, Eurydice, Oct 2011.

formal CPD activities for teachers. Given the importance of this project, industry would be willing to engage with the education system in developing such an approach.