The Junior Certificate Science –Revised Syllabus

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Abstract. *In 1989, a revised science syllabus was introduced into Irish Second Level schools, which incorporated some aspects of applied science e.g. electronics and food science.*

This syllabus was found to be too long allowing little time for proper scientific processes and investigations and no reward was given to the students for practical work. The syllabus committee was reconvened in 1998 and a review of the syllabus was undertaken again.

The content of the syllabus was reduced and students will now be awarded marks for completing their practical work at the end of the three year cycle.

The revised Junior Certificate syllabus is activity-based in its design, emphasising the individual's experience of science as a 'hands-on' one. The importance of the processes of science, as well as knowledge and understanding, is reflected in the syllabus structure. Through a variety of investigations and experiments, students attain the specified learning outcomes, developing appropriate science process skills and a knowledge of underlying science conceptsStudent motivation, collaborative working and opportunities for discussion are all part of learning science using an investigative approach, as is the opportunity for students to reflect on, and evaluate, their own work and progress.

In performing investigations students have to make their own decisions, either individually or in groups. They have a certain amount of control over how the investigation is carried out and in doing so can take some responsibility for their own learning. Students have to use procedures such as planning, measuring, observing, analysing data and evaluating.

However, no matter how open-ended an investigation is, the teacher still plays a pivotal role in how the investigation is carried out and how useful the experience is for the student.
In my presentation I will give an overview of the syllabus and relay the experience of teachers and in-service providers of implementing the revised syllabus.

Keywords. *Rationale, Content, Structure, Practical activities, Assessment, Professional Development*

Introduction

Pupils enter the secondary system at age twelve and complete a five to six years programme.

In the first three years the students take on average ten subjects and sit their first formal state exam at the end the this three year cycle. This is called the Junior Certificate exam. Science is a taken by the majority of pupils but it is not a core subject in all schools – many schools offer science as an option subject.

Prior to 1989 there were two science syllabi (similarly for other subjects) Syllabus A and Syllabus E. The latter was taken by a small number of pupils in vocational schools and included a project component for final assessment.

The Department of Education and Science (DES) decided to combine both syllabi into one and asked the NCCA course committee to examine both and produce a new syllabus. The syllabus was to be examined at two levels – Higher level and Ordinary level. This was also in line with all other subjects. The syllabus was ready for incoming first years in 1989 and for examination in 1992. It will be examined for the last time for the majority of schools in 2005 and is referred to as the current syllabus.

The current syllabus is divided into four sections- physics chemistry biology and applied science. The applied science section contains topics such as material science, horticulture, earth science, food science, and electronics and energy. The students have to study physics, chemistry biology and any two of the six sections from applied science. However, students taking

Main Topic	Sub-topic	Learning Outcomes Students should be able to
1A1 Food	Examine the content of a variety of foods as described on their labels Food as a necessary source of energy and growth material for the body Constituents of a balanced diet	Recall that a balanced diet has six constituents: carbohydrates, (incl fibre) fats, proteins, minerals, vitamins and water Each with different function. Describe a food pyramid and give examples of food recommendede for a balanced diet Carry out qualitative food tests for starch, protein reducing sugar and fat. Read and interpret labels and compare energy content of foods **Investigate the conversion of chemical energy in food to heat energy**

the ordinary level course only study any three of the sections biology, physics, chemistry and applied science. Some students can opt to omit the applied science section and submit a 'local studies' project instead. There is no assessment of practical work.

After a number of years of examining this syllabus a number of issues came to light:

(i) The students taking the syllabus at lower level were omitting the chemistry section in favour of the applied science section and within this section food science and material science were most popular.

(ii) There was an obvious under representation of chemistry in the applied science section.

(iii) The number of students taking physics and chemistry at senior level was falling.

(iv) The course was too long for all students to have hand-on experience for all the prescribed practical activities.

The DES at this time withdrew dedicated funding for science from schools. Instead the school got general funding for the whole school with recommendations for the amount to be spent on science.

In 1998, the DES asked the NCCA to reconvene the course committee and revisit the syllabus to try to restore the balance of physics and chemistry to the syllabus.

The course was to be shortened in line with other subjects at Junior Certificate.

The NCCA course committee comprises teachers from different sectors within the profession. There are representatives from the teacher unions, the ISTA, inspectorate, third level sector, schools managerial body, and the NCCA itself.

The committee began meeting in late 1999 and began and overhaul of the syllabus. It was ready for implementation in Sept 2003 for the incoming first year pupils. About 10% of schools in 2003 however felt they could not implement the revised syllabus at this time and were given a derogation by the DES to continue with the current syllabus. Almost all of these schools began to teach the syllabus in 2004.

The consequence of this action by these schools is that in 2006 there will be two examinations –one based on the new syllabus and one based on the current syllabus.

Revised Syllabus structure and content

The syllabus reverted to the 'old' type syllabus in that there are three main sections- physics, chemistry and biology. Some content from the applied science was incorporated into the appropriate section e g. food tests are now in the biology section and electronics are introduced in physics. Some content had to be omitted to reduce the content and to allow time for a hand-on approach to practical activities. The current syllabus has no mandatory practical and no from of assessment of practical work.

The revised course is activity based in its design. It emphasises the practical nature of science. A wide range of teaching methods is encouraged as is the use of dataloggers for collecting the results of experiments. The table below is an example of one section of the biology course. The topic is Food. It is hoped that the learning outcomes will be achieved through teacher instruction, discussion and practical work.

Practical Activities

It is hoped that the practical activities will encourage observation, promote logical thinking, develop skills, arouse interest in science and make it more real. Having completed the practical activities it is hoped pupils will emerge with a well developed logical thinking and problem solving skills.

Activities fall into two main categories – investigations and experiments.

Investigations are processes where the pupil will seek information about a topic in a manner that is not predetermined in either procedure or outcome.

e.g. investigate the reaction between zinc and hydrochloric acid.

Experiments are testing a theory or confirm a hypothesis.

e.g. carry out a test for starch on a sample of food.

The importance of process over product in carrying out the activities as well as knowledge is reflected in the structure of the syllabus.

This is also reflected in the chemistry, physics and biology syllabi at senior level.

Thirty of the practical activities are described as mandatory and students will be awarded credit for doing these activities. This is the first time that students are being awarded for doing practical activities in any of the science subjects. There is not however a practical examination.

In the second term of the third year the DES will send three activities to all students. Students will carry out an investigation on any two of the three investigations. Students may opt to choose their own investigation if they wish. This proviso is to cater for students who previously would have taken the local studies project.

Assessment

The science syllabus will be examined at the end of the three year cycle as part of the Junior Certificate Examination. The first examination will be in 2006. The final grade is based on three separate course work

Coursework A	Coursework B	Coursework C
Experiments and investigations specified in the syllabus Marks: 10%	Additional specified investigations or one investigation of the student's own choice Marks: 25%	**Terminal examination** Section 1: Biology Section 2: Chemistry Section 3: Physics Mark 65%

Coursework A – mandatory experiments and investigations

In each of the main sections of the syllabus, ten experiments or investigations are identified as mandatory (indicated in bold print in the syllabus). These represent a minimum of practical work. Each student must keep his/her own individual record of these thirty activities over the three years of the course, and this must be available for inspection. As part of the assessment, marks will be awarded on a pro rata basis for the satisfactory completion of this coursework.

Coursework B – student assignments

In the third year of the course, students will be required to carry out two specified investigations, which will be based on the topics and learning outcomes in the syllabus. These will be set by the State Examinations Commission and will vary for each yearly cohort of examination candidates. As an alternative to the set investigations, a student may substitute a single investigation of his/her own choosing, provided that it meets the criteria laid down by the State Examinations Commission.

Students will complete their investigations under the follow headings:

My interest in carrying out this investigation

Period in which the investigation was carried out

Introduction to the investigation (including background research undertaken in preparation for

the investigation: people, books, websites, etc. as sources of relevant information)

Preparation and planning

(i) List of the equipment needed for the investigation

(ii) List of tasks to be carried out during the investigation

(iii) Particular safety precautions required by this investigation

Labelled diagram (where appropriate)

Procedure followed in the investigation

Recorded data / observations

Calculations / Data analysis

Conclusions and Evaluation

By arrangement with the school authorities, the set of reports should be submitted for retention in the school no later than the date of the terminal examination for Junior Certificate science.

Coursework B serves a dual function. It allows for assessment of the learning in science that has taken place over the previous years, that is, the extent to which the student has developed the skills necessary to conduct scientific inquiry, to think critically and logically, and to make evidence-based conclusions. At the same time, it integrates, and acts as a revision of, the knowledge and understanding that might be required when answering questions on the examination paper that are related to science investigations.

Terminal examination paper

There will be separate Ordinary level and Higher level examination papers, each with three sections corresponding to the structure of the syllabus. The examination papers will assess the candidates' knowledge and skills in relation to topics and learning outcomes in the syllabus. Separate examination papers will be set for Ordinary level (1½ hours) and Higher level (2 hours). Each examination paper will be in booklet form, with appropriate provision for candidates to enter their answers on the examination booklet itself.

Teacher Training and Professional Development.

The DES appointed a support team in Sept 2003 Ten teachers were seconded and began intensive inservice training for teachers. The inservice training was held regionally and for small groups of teachers. Unlike the previous inservice programme DES provided funding for substitution for teachers attending inservice. Attendance at in service in voluntary and the uptake is about 80%. The inservice programme provides an intensive training not only on the contents of the course but on different methodologies that could be used in teaching, and carrying out the activities.

There is greater emphasis on a hand-on approach to the teaching practical activities.

The DES also provided substantial grants for schools to purchase the necessary equipment to successfully implement the revised syllabus. This grant was awarded on the basis of the age and state of the existing laboratory/ies.

Summary

In the junior cycle, the study of science contributes to a broad and balanced educational experience for students. Science education in the post-primary junior cycle is concerned with the development of scientific literacy and associated science process skills, with an appreciation of the impact that science has on our lives and environment. In the age of rapid scientific and technological change, the study of science is fundamental to the development of the confidence required to deal with the opportunities and challenges that such change presents in a wide variety of personal and social contexts.

Arising out of their experience in the junior cycle, it is hoped that many students will be encouraged to study one or more of the science subjects in the senior cycle, thus preparing themselves for further study or work in this area.

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References

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