



EDUCATION AND TRAINING INSPECTORATE

Better Science

March 2008

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BETTER SCIENCE

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1. INTRODUCTION

- 1.1 In 1995, the Education and Training Inspectorate (Inspectorate) published a document entitled, “Evaluating Schools” which set out the criteria used to evaluate the quality of whole-school provision. In 1999, ETI published, “*Evaluating Post-primary Science*”, which outlined the criteria used to evaluate the quality of learning and teaching in science in post-primary schools. A further publication in 2001 entitled, “*Improving Science*” summarised the strengths, areas for improvement and priorities for action, based on visits to science departments in the period 1996 to 2000.
- 1.2 Many developments in the science education landscape have occurred since the publication of “Improving Science”. The ‘Science for All’ policy for pupils aged 5 to 16 years, set within the Curriculum Reform Order of 1989, has, over the years, been successful in providing pupils of all abilities with meaningful experiences and recognised qualifications in science. In particular, girls and lower achieving pupils have benefited significantly. The Northern Ireland Curriculum, which was put in place in 1989, has been revised, placing a much stronger emphasis on acquisition of important skills such as critical thinking and active learning. The revised curriculum was implemented for year 8 pupils in September 2007.
- 1.3 The process of self-evaluation as a means of promoting improvement in provision has become embedded in schools. Education and Library Board officers, working with the Inspectorate, have produced a valuable online resource to assist science departments evaluate their provision.
- 1.4 In the same period, a number of influential reports such as the Roberts’ Review (2002) and the Sainsbury Review of Science and Innovation (2007) have highlighted the decrease in uptake of science subjects, particularly at post-

16 and undergraduate degree level, and underlined the negative consequences for economic well-being in the United Kingdom. The fall in the uptake of post-16 physical science courses in schools and colleges in Northern Ireland, as well in Great Britain, continues to cause concern.

- 1.5 In 2006, the then Minister of Education, and of Employment and Learning commissioned a review of Science, Technology, Engineering and Mathematics (STEM) provision in NI. The findings of the STEM Review, which are due in summer 2008, will provide an important context for all aspects of science education.
- 1.6 The Chief Inspector's Report 2004-2006, sets out five recurring themes - diversity and mutual understanding, special educational needs, improving learning and teaching, improving leadership and management and using ICT - which are important priorities for science education.
- 1.7 Inspection data gathered over the last five years demonstrates improvements in science provision; however, significant areas for improvement still need to be addressed. It is therefore timely to update the findings of, 'Evaluating Post-primary Science' and 'Improving Science' to provide a basis for science departments to self-evaluate their work more effectively, in the interest of learners.

2. ETHOS

2.1 The ethos in most science departments supports the pupils' learning.

2.2 In the best practice:

- ☺ the working relationships between the teachers and the pupils are good;
- ☺ the pupils are interested in science and motivated by the experiences provided;
- ☺ the teachers are aware of the needs of individual pupils;
- ☺ the teachers and pupils co-operate to achieve common goals;
- ☺ the laboratories are used creatively to present science as an exciting, relevant and interesting subject; and
- ☺ the pupils' are keen to take part in competitions and visits to places of scientific interest.

2.3 In the weaker practice:

- ☹ there is little evidence of an atmosphere of discovery, investigation and wonder among teachers and pupils; and
- ☹ science is not valued as an important area in everyday life.

3. PLANNING

3.1 There is a wide variation in the quality and extent of the planning for science in post-primary schools.

3.2 In the best practice:

The schemes of work, which reflect the Northern Ireland Curriculum and/or examination syllabuses, are available for all year groups and they provide clear and helpful guidance on teaching and learning. They set out:

- 😊 the content and/or skills to be learned;
- 😊 the learning intentions for individual and /or groups of lessons;
- 😊 the teaching strategies to be used;
- 😊 the resources required;
- 😊 the methods of assessing the extent to which the learning intentions are realised in practice; and
- 😊 the science department's evaluation of the effectiveness of the teaching strategies deployed.

The teachers are well prepared for all individual lessons.

3.3 The planned work:

- 😊 is suitably matched to the needs and abilities of all pupils and provides stimulation and challenge;
- 😊 provides well-defined opportunities for the development of the pupils' scientific enquiry skills through a variety of linked activities which include purposeful and

investigative practical activities and open, critical discussion;

- ☺ identifies when and how ICT software and hardware is used to help the pupils learn science; and
- ☺ includes opportunities for consolidation of learning.

3.4 In weaker practice:

- ☹ the planning for learning is sketchy;
- ☹ there is over-reliance on commercial schemes;
- ☹ the work is not differentiated to match the needs of the spectrum of abilities in classes;
- ☹ there is a poor match between planning and delivery of lessons.

4. TEACHING

4.1 There is wide variation in the quality of science teaching in post-primary schools.

4.2 In the best practice the teachers:

- ☺ blend clear explanation with relevant questions to extend the pupils' understanding of the application of scientific ideas to human, industrial and environmental contexts;
- ☺ formulate clear learning intentions for their lessons, share the intentions with the pupils, refer to the learning intentions where appropriate throughout the lesson and use the learning intentions at the end of the lesson to monitor and assess the extent of the pupils' learning;
- ☺ encourage realistically high expectations of all of their pupils;
- ☺ use a variety of teaching strategies which engage the pupils actively in their own learning and accommodate a range of learning styles;
- ☺ provide an extensive range of practical work where individual pupils have opportunities to handle apparatus and materials on a regular basis, to plan motivating investigations to test hypotheses and to reinforce their understanding of scientific principles;
- ☺ ask the pupils challenging questions which develop their thinking and communication skills, extend their understanding of the application of science in real situations and consolidate their grasp of important scientific concepts;

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- ☺ provide the pupils with many good opportunities to use their ICT skills to learn science;
 - ☺ encourage the pupils to think critically about what they learn and to be able to explain what they have learned to their peers;
 - ☺ engage in collaborative planning with other subject departments such as mathematics, technology and English; and
 - ☺ use resources which are fit for purpose.

4.3 In contrast, in weaker practice:

- ☹ note taking is the predominant activity in lessons;
- ☹ the work lacks pace and purpose;
- ☹ time-filling activities such as completing unchallenging work sheets abound; and
- ☹ there are too many teacher demonstrations of practical activities at the expense of the pupils' active engagement in practical work.

5. LEARNING

5.1 In the best practice:

- ☺ good relationships between the teachers and the pupils promote effective learning;
- ☺ the pupils are interested in science and are well-motivated to learn;
- ☺ the pupils are responsive during lessons and they cooperate readily with their teachers;
- ☺ the pupils work safely on practical activities and cooperate effectively when working in groups;
- ☺ the pupils can identify and apply their science to everyday situations; and
- ☺ the pupils are confident, ask relevant questions and are keen to extend their learning.

5.2 In the weaker practice:

- ☹ the pupils are reluctant to engage in learning and are passive recipients of information;
- ☹ the pupils do not take opportunities to consolidate their learning by relating theoretical and practical work.

6. ASSESSMENT

6.1 In the best practice:

- ☺ the science teachers supervise the pupils' work regularly and systematically;
- ☺ good records of pupils' performance are maintained and used to monitor progress, the records are used to respond to individual pupil needs;
- ☺ the pupils are aware of the standards they have attained and what they need to do to improve;
- ☺ purposeful homework is set regularly and marked with improvement in mind;
- ☺ assessment for learning is well understood and utilised by the teachers;
- ☺ success is celebrated to enhance the pupils' confidence, motivation and self esteem; and
- ☺ teachers use the outcomes from pupil assessment to self evaluate their teaching strategies and resources used.

6.2 In the weaker practice:

- ☹ marking is infrequent and inconsistent, resulting in pupils being unsure of what is required to improve their performance;
- ☹ teacher's written comments are often negative and provide little information on how they pupils could improve their work; and
- ☹ agreed standards of work and presentation are not adhered to.

7. LEADERSHIP AND MANAGEMENT

7.1 In the best practice:

- ☺ the Head of Department (HoD) has a clear vision for the development of science in the school and provides a good role-model for the staff;
- ☺ the development plan reflects whole-school as well as departmental priorities, is monitored and evaluated on a regular basis and adjusted in the light of evidence collected;
- ☺ the teachers display a strong sense of collegiality and are supportive of one other;
- ☺ regular departmental meetings provide a forum for discussion of ideas to promote improvement in the pupils' learning as well as routine administrative matters;
- ☺ monitoring and evaluating the quality of science provision is central to the work of the department. An on-line self-evaluation resource, produced by Education and Library Board science support staff, is used effectively to promote improvement in the science department. Staff development activities reflect the identified areas for improvement;
- ☺ good practice is disseminated in the department; team teaching, peer observation and critical reflective practice are integral to the culture of the department;
- ☺ all pupils of statutory school age have opportunities to study broad and balanced science courses in post-primary schools. Available courses should ensure equity, that is, fairness and inclusion for all pupils; and
- ☺ the HoD uses comparative data to set realistic performance targets for the pupils.

8. CONCLUSION

- 8.1 Better science teaching is vitally important in today's world. Issues such as education for sustainable development, the need for citizens to be scientifically literate, the importance of science for economic prosperity in Northern Ireland and the recent PISA findings, which show that many young people have negative attitudes towards science, set out a significant challenge for science education professionals in schools. Much has been achieved and much remains to be done.

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