

Education and Training Inspectorate

Report of a Survey

Science Provision in Further Education Colleges

Inspection: 2003/2004



Providing Inspection Services for

Department of Education
Department for Employment and Learning
Department of Culture, Arts and Leisure



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A number of quantitative terms are used in the report. In percentages, the terms correspond as follows:-

More than 90%	-	almost/nearly all
75%-90%	-	most
50%-74%	-	a majority
30%-49%	-	a significant minority
10%-29%	-	a minority
Less than 10%	-	very few/a small number.

1. INTRODUCTION

- 1.1 This report is based on evidence drawn from visits by specialist inspectors to science courses in six of the 16 further education (FE) colleges/institutes in Northern Ireland (NI). The visits took place between September 2003 and June 2004. (See Appendix 1)
- 1.2 During the visits the inspectors had discussions with college directors, other members of senior management teams and science staff. Employers and participating learners were also interviewed. The members of the inspection team observed the quality of learning and teaching and they examined course documentation and self-evaluation reports provided by the staff. At the end of each visit, each college received from the visiting inspector, an oral report which outlined strengths and possible areas for improvement.
- 1.3 Further evidence relating to provision for science in the FE sector was provided by an on-line questionnaire, (see appendix 3) which all 16 colleges completed.
- 1.4 The aims of the survey were to:
- evaluate the quality of learning and teaching in science in the participating colleges;
 - provide a baseline position on the extent of, and the current strengths in the science provision in the FE sector in NI;
 - identify areas for improvement in science provision.
- 1.5 Although science is taught in many FE courses in vocational areas such as engineering, construction, health studies and food studies, the survey focused on courses where science was the predominant area of study. The courses included in the scope of the survey are set out in appendix 2. The analysis and conclusions reached in the report are based on the inspection evidence from the inspection visits and the statistical information provided by the colleges.

2. SUMMARY OF MAIN FINDINGS

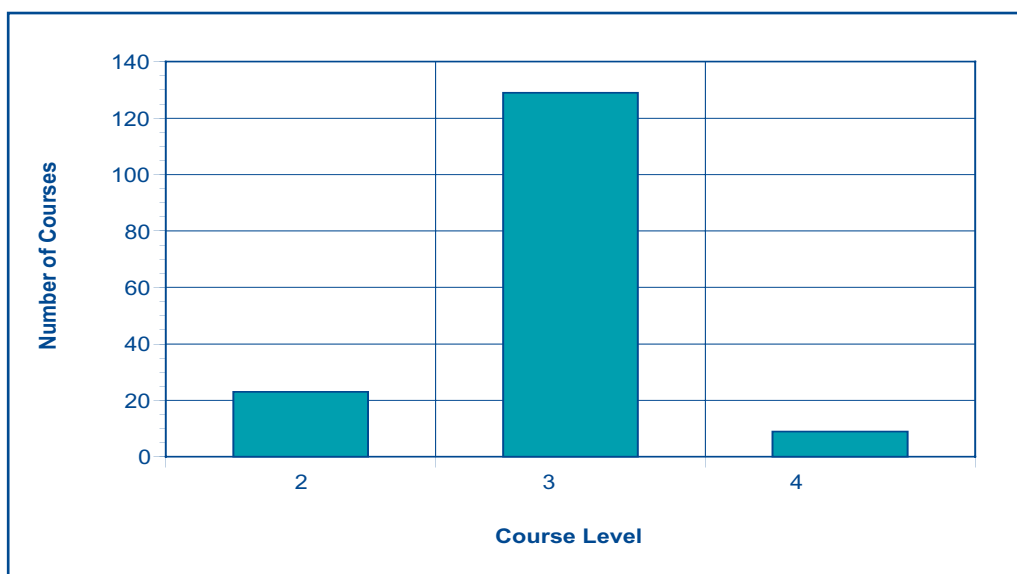
- 2.1 The majority of science courses are at level 3; there are few higher-level courses in the colleges.
- 2.2 The demand for Access science courses, which provide entry to higher education for mature students, is growing; concurrent with this trend, is a reducing demand for traditional science courses.
- 2.3 The majority of students interviewed during the survey have aspirations to work in the health and caring professions.
- 2.4 Only a few of the science courses surveyed provide direct opportunities to gain employment in a vocational area requiring specialist scientific skills and knowledge.
- 2.5 Half of the colleges have developed their curriculum by providing bespoke science courses for industry in their local area.
- 2.6 A few colleges have introduced innovative science programmes at levels 2 and 3 that provide school leavers with opportunities to gain employment in environmental science and agriculture.
- 2.7 Modern science accommodation with storage and areas for project work are urgently required in the majority of colleges.
- 2.8 The positive ethos in science classes and the range of teaching approaches contribute to good learning experiences for the students.
- 2.9 In the vast majority of lessons observed during the survey, the strengths outweighed any weaknesses. In the best practice the teaching methods were chosen to meet the needs of the learners and to facilitate their progress; in a few lessons observed, where the teaching was overly didactic, the learners were not sufficiently engaged and less learning occurred.
- 2.10 There is evidence of a few college managers adopting proactive approaches to the development of science provision in their colleges.
- 2.11 The FE sector does not have a coherent science strategy, which is linked to the needs of the NI economy.

- 2.12 Fewer than 50% of the science staff have attended science-based staff development courses in 2002/03; just over 50% have visited science-based industries in the recent past. Science-based staff development both within the colleges and in the work place is an urgent priority.
- 2.13 Approximately 50% of the science courses in the scope of the survey make significant use of Information and Learning Technology (ILT) to enhance the students' learning.
- 2.14 The standards reached by learners in science classes broadly reflect their experience and ability. Many good examples of learners developing independence and extending their own learning were observed.
- 2.15 Given the significant cost of providing high quality practical science facilities for students, there is scope for rationalisation and specialisation of science provision in NI colleges.

3. PROVISION

- 3.1 The science curriculum in colleges comprises a wide range of courses, reflecting the three main scientific disciplines; a majority of science courses are at level 3 as illustrated in Figure 1 below. Level 2 courses are well represented, but there are relatively few level 4 courses.

Figure 1



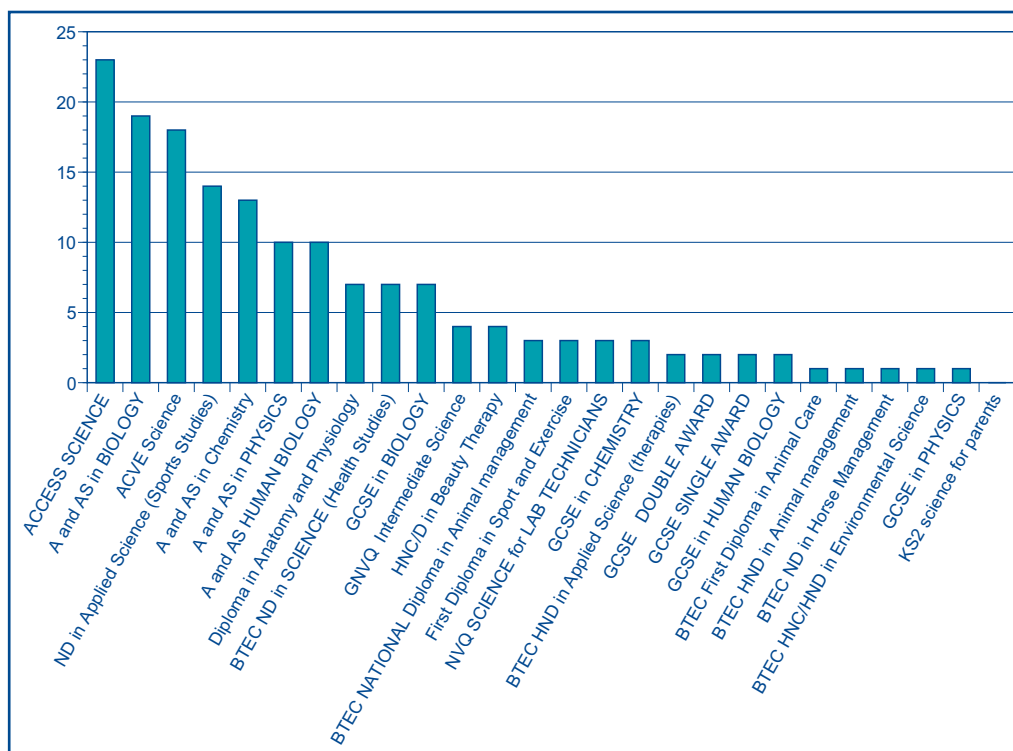
- 3.2 The science courses included in the scope of the survey can broadly be classified into traditional academic science such as: Advanced-level General Certificate of Education (GCE) courses; vocational science courses such as Advanced Vocational Certificate in Education (AVCE) or the National Diploma (ND) in Science, and Access courses for adult learners who have little prior scientific knowledge and are seeking entry to university.

Table 1 below illustrates the relative frequency of the science courses in the colleges, expressed as a percentage of the total number of courses included in the scope of the survey.

Science courses in the colleges	Percentage
ACCESS SCIENCE	14
A and AS in BIOLOGY	12
ACVE Science	11
ND in Applied Science (Sports Studies)	9
A and AS in Chemistry	8
A and AS in PHYSICS	6
A and AS HUMAN BIOLOGY	6
Diploma in Anatomy and Physiology	4
BTEC ND in SCIENCE (Health Studies)	4
GCSE in BIOLOGY	4
GNVQ Intermediate Science	2
HNC/D in Beauty Therapy	2
BTEC NATIONAL Diploma in Animal management	2
First Diploma in Sport and Exercise	2
NVQ SCIENCE for LAB TECHNICIANS	2
GCSE in CHEMISTRY	2
BTEC HND in Applied Science (therapies)	1
GCSE DOUBLE AWARD	1
GCSE SINGLE AWARD	1
GCSE in HUMAN BIOLOGY	1
BTEC First Diploma in Animal Care	1
BTEC HND in Animal management	1
BTEC ND in Horse Management	1
BTEC HNC/HND in Environmental Science	1
GCSE in PHYSICS	1
KS2 science for parents	0

Table 1 Frequency of provision of courses in FE.

Figure 2



- 3.3 Access courses, which provide good opportunities for adults with a limited scientific background to prepare for entry into science courses in higher education, are growing in demand and represent an increasing area of work for science teachers in colleges. Concurrent with this trend, there is a reducing demand for traditional science courses such as GCEs in chemistry, physics and biology.
- 3.4 There is wide variation in the number of science courses provided in individual colleges. A few colleges currently provide only a small number of courses with few obvious routes of progression, while others provide a full range of courses. Given the cost of providing high quality practical science facilities for students there is scope for rationalisation and specialisation.
- 3.5 The science courses included within the scope of the survey invariably assist students to improve their employment prospects and/or to gain entrance to Higher Education (HE). The majority of students interviewed during the survey have aspirations to work in the health and caring professions.

- 3.6 A few of the science courses surveyed, provide direct opportunities to gain employment in a vocational area requiring specialist scientific skills; for example, tutors of animal management courses report that students gain employment readily in, for example, veterinary practices and in animal shelters. A large urban college has drawn upon a recent consultant's report to adjust their science provision to meet present and future employment patterns in their local area.
- 3.7 About 50% of colleges have developed their curriculum by providing bespoke specialist courses for industry in their local area. Most of these courses are in health related areas. Science staff are generally keen to expand their provision for local industry but, they are not always well informed of local needs; few colleges have a clear strategy for developing links with science-based industries.
- 3.8 A few colleges have introduced innovative science programmes that provide school leavers with opportunities to gain employment in the local area; for example, a rural college is offering a National Diploma course aimed at school leavers interested in pursuing a career in agriculture or environmental science.
- 3.9 Information on the accommodation and resources available for science in the colleges was obtained from survey visits and from the on-line questionnaire completed by all the colleges. Approximately 60 specialist science laboratories are available in the colleges. The fitness for purpose and appearance of the laboratories varies significantly; a majority is in need of refurbishment, about 60% are not up to modern industry standards. Many examples of outdated equipment were observed during the survey. A minority of science courses have adequate apparatus and equipment. Modern accommodation with suitable storage and areas for project work are urgently required.

4. LEADERSHIP AND MANAGEMENT

- 4.1 Most college managers are beginning to adopt more proactive approaches to science provision; for example, one college is exploring ways of developing high technology courses such as biotechnology, while another college is developing an innovative programme, which involves research into renewable energy technology and waste

management. Colleges need to explore further the feasibility of developing such applied science courses.

- 4.2 About 75% of colleges are planning to increase their range of science related courses in 2004/05. They range from higher-level courses such as Foundation Degrees in Applied Sciences to horticultural courses at level 2 for students with few qualifications.
- 4.3 The science courses visited during the survey were located within a single department or in a number of different departments. The fragmentation of science in colleges does not facilitate development planning which links curriculum development, staff development and resource management. This fragmentation is particularly apparent in large colleges.
- 4.4 The results from survey visits and from the online questionnaire indicate that there are approximately 90 appropriately qualified science teachers in the colleges. Fewer than 50% of the science teachers have attended science-based staff development courses in 2002/03. Just over 50% had visited science-based industries in the recent past. Science-based staff development, both within the colleges and in the work place, is an urgent priority.

5. THE QUALITY OF TEACHING AND LEARNING

- 5.1 The ethos in science classes generally promotes the full development of the learners. Mature and adult relationships are very evident in most classes.
- 5.2 The learning environment in the laboratories visited varies from stimulating to dull and unimaginative. In the majority of the laboratories, science is not presented as an exciting and relevant area of study and interest. The dated accommodation in most colleges reinforces this dull image.
- 5.3 In the vast majority of lessons observed during the survey, the strengths outweighed the areas for improvement. In the best practice the teaching methods met the needs of the learners and facilitated their progress. Many good examples of the application of science in everyday life were used well to underpin the theoretical knowledge

being taught. Adult learners often drew upon their experiences in the work place to illustrate scientific principles covered in their courses. The older students, in particular, frequently posed challenging and relevant questions that addressed important ethical aspects of science; in one class, for example, they debated whether or not badgers, which carry tuberculosis, should be culled? The work provided in lessons is generally well matched to the needs of the learners; good account is taken of the previous learning experiences of adults returning to education and the pace of their work is in line with their rates of progress. In a few lessons observed, where the teaching was overly didactic, the learners were not sufficiently engaged and less learning occurred.

- 5.4 In most of the courses observed there is a good balance between practical and theoretical work.
- 5.5 The science teachers in colleges place a strong emphasis on supporting the students' learning. When students unavoidably miss classes, the teachers provide excellent tutorials and support materials. A few examples of on-line materials were evident.
- 5.6 Although many adult students returning to learning overcome substantial challenges, associated with work and family commitments, poor attendance frequently restricts their progress.
- 5.7 Approximately 50% of the science courses in the scope of the survey make significant use of Information and Learning Technology (ILT) to enhance the students' learning. Only about 10% of science courses make optimum use of e-learning facilities in the colleges.

6. STANDARDS AND OUTCOMES

- 6.1 The standards reached by learners in the science classes visited, broadly reflect their experience and ability. Many good examples of learners developing independence and extending their own learning were observed. A particular strength of the provision was the learners' understanding of their own learning goals and their grasp of progression routes into HE. Outcomes, such as adult students raising their expectations of what they might achieve through their experience of college, were less tangible but significant.

7. CONCLUSION

7.1 There are strengths in the science provision in the FE sector in NI and areas for improvement.

7.2 The main strengths are:

- the ethos in science classes and the range of teaching approaches which contribute to the good learning experiences of the students;
- the quality of the teaching in the majority of classes visited;
- the standards achieved which broadly reflect the students' experience and ability;
- the good opportunities provided by Access science courses for adults to return to study science and progress to higher education;
- the innovative science programmes, which have been introduced by a few colleges, provide school leavers with good opportunities to gain employment in science based industries;
- the specialist bespoke courses for industry providing by about half of the colleges.

7.3 The main areas for improvement are:

- the need for a coherent science strategy, which is linked to developing the NI economy;
- the rationalisation and specialisation of science provision in NI colleges;
- the provision of appropriate modern science accommodation and resources;
- the need for an integrated programme of curriculum development, staff development and resource management in science.

Appendix 1

INSTITUTIONS VISITED BY INSPECTION TEAM

Armagh College of Further Education

Belfast Institute of Further and Higher Education

East Antrim Institute of Further and Higher Education

Lisburn College of Further and Higher Education

North East Institute of Further and Higher Education

Omagh College of Further Education


Appendix 2

COURSES WITHIN THE SCOPE OF THE SURVEY

ACCESS SCIENCE
A AND AS GCE IN BIOLOGY
ACVE SCIENCE
ND IN APPLIED SCIENCE (SPORTS STUDIES)
A AND AS IN CHEMISTRY
A AND AS IN PHYSICS
A AND AS HUMAN BIOLOGY
DIPLOMA IN ANATOMY AND PHYSIOLOGY
BTEC ND IN SCIENCE (HEALTH STUDIES)
GCSE IN BIOLOGY
GNVQ INTERMEDIATE SCIENCE
BTEC NATIONAL DIPLOMA IN ANIMAL MANAGEMENT
FIRST DIPLOMA IN SPORT AND EXERCISE
NVQ SCIENCE FOR LAB TECHNICIANS
GCSE IN CHEMISTRY
BTEC HND IN APPLIED SCIENCE (THERAPIES)
GCSE DOUBLE AWARD
GCSE SINGLE AWARD
GCSE IN HUMAN BIOLOGY
BTEC FIRST DIPLOMA IN ANIMAL CARE
BTEC HND IN ANIMAL MANAGEMENT
BTEC ND IN HORSE MANAGEMENT
BTEC HNC/HND IN ENVIRONMENTAL SCIENCE
GCSE IN PHYSICS
KS2 SCIENCE FOR PARENTS

Appendix 3

QUESTIONNAIRE SENT TO COLLEGES

 Survey of Science in FE

NAME OF FE INSTITUTE:

Section 1 - Curriculum

1.1 Please indicate how many science courses your Institute is currently offering at levels 2, 3 or 4 and how many are full-time (FT) or part time (PT):

Course	Number of courses					
	Level 2		Level 3		Level 4	
	FT	PT	FT	PT	FT	PT
ACVE Science						
GNVQ Intermediate Science						
BTEC First Diploma in Animal Care						
BTEC NATIONAL Diploma in Animal Management						
BTEC HND in Animal Management						
BTEC ND in Horse Management						
Diploma in Anatomy and Physiology						
HNC/D in Beauty Therapy						
NVQ in Beauty Therapy						
BTEC HND in Applied Science (therapies)						
BTEC HNC/HND in Environmental Science						
First Diploma in Sport and Exercise						
ND in Applied Science (Sports Studies)						
BTEC ND in SCIENCE (Health Studies)						
NVQ SCIENCE for LAB TECHNICIANS						
A and AS in BIOLOGY						
A and AS in PHYSICS						
A and AS in CHEMISTRY						
A and AS HUMAN BIOLOGY						
GCSE DOUBLE AWARD						

GCSE SINGLE AWARD						
GCSE in BIOLOGY						
GCSE in PHYSICS						
GCSE in CHEMISTRY						
GCSE in HUMAN BIOLOGY						
ACCESS SCIENCE						
KS2 science for parents						

1.2 If you have indicated in question 1.1 that you offer an Access Science course, how many Access students took up university places in 2002/2003?

1.3 Does your Institute provide specialist science courses for industry i.e. courses for employees requiring specific scientific skills? Yes No

If **yes**, please provide details:

1.4 What additional Science courses which you are not offering at present would you wish to offer in 2004/2005?

Section 2 - Accommodation

2.1 How many Science laboratories are there in the Institute?

2.2 How many of the laboratories are not fit for purpose i.e not comparable with modern standards in industry.

2.3 How many of the laboratories have adequate storage?

2.4 Do students have sufficient space to complete assignments/project work? Yes No

2.5 Estimate how many laboratories are needed in the Institute to offer a range of science related courses?

2.6 Is your current science provision well matched to the needs of the local industry?
 Yes
 No

If No, please provide details:

2.7 What proportion of science teaching for the courses covered by this survey takes place outside laboratories? %

Section 3 - Resources

3.1 Do you have sufficient apparatus to teach the courses offered at present?
 Yes
 No

3.2 Do you have sufficient consumable materials for practical work?
 Yes
 No

3.3 If you answered **no** to question 3.1 or 3.2, please comment on how this impacts on student learning?

3.4 What proportion of science courses make significant use of ILT? %

3.5 What proportion of science courses can be accessed through E learning? %

3.6 What was the budget for scientific materials and apparatus in 2002/2003?

3.7 Do you feel the budget is adequate?
 Yes
 No

3.8 If the budget is inadequate, what should your budget be?

Section 4 – Staff

4.1 How many **full time** science lecturers are involved in the teaching of the science courses covered by this survey?

4.2 Of these, how many attended science-based staff development courses in 2002/2003?

4.3 How many science technicians service the courses covered by this survey?

Section 5 – Links

5.1 How many science staff visited science based industries in :
2001/2002
2002/2003

5.2 What have your science staff done to promote the public understanding of science in your local area? E.g. short course in astronomy, ethical issues, and exhibitions of scientific interest.

5.3 How does your Institute encourage students to develop business ideas based on science with for example local development agencies? Ideas might be for example, marketing organic products

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