The Implementation
of the
National-Curriculum Science
Key Stage 3
1989 - 1992
Six Case Studies
by
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Abstract

The Education Reform Act of 1988, brought about the most far reaching changes to the education system of England and Wales since the 1944 Education Act.

The climate of change was instigated when James Callaghan gave his famous Ruskin Speech in 1976 and was further secured by Sir Keith Joseph highlighting the education system's deficiencies and preparing public opinion for change. The climate of change in Science Education was fostered by such documents as "Science 5-16 - A Statement of Policy" and the work of the Association for Science Education and the School Science Review and others which called for a broad and balanced science education for all pupils from 5-16.

Part of the 1988 Act required the Secretary of State for Education to establish a National Curriculum of ten subjects, starting first with the core subjects of English, mathematics and science. The research looks at how the National Curriculum for Science was shaped and communicated to teachers. A case study approach was used to identify the aspects of policy and practice which had supported the introduction and the implementation of the science curriculum and its assessment.

The case study schools were in an LEA which was considered to be in the forefront of curriculum development and so part of the research describes the context and readiness of these schools to implement the National Curriculum.

The research shows that both the Science Working Group and the Task Group on Assessment and Testing managed to carry science teachers with them as they wrestled with a structure for the National Curriculum and its assessment which would find favour with the Secretary of State for Education. The research also hints at the possibility that ultimately there may have been a lack of congruence with the vision of the Secretary of State for Education and that of the Science Working Group and the Task Group on Assessment and Testing.

On reading about the complexity of the administrative demands of the National Curriculum the reader may have a sense of frustration. This frustration can only be a faint echo of that felt by teachers as they tried to create and then implement their own vision of the National Curriculum and its assessment.
At school level the implementation was a radical change representing as it did a complete polarisation - prior to the National Curriculum science teachers had enjoyed influencing curriculum development in what could be called a periphery to the centre model, that is, where grass root developments by teachers had an influence and impact on the teaching of science both locally and nationally. Now they were faced with the complete reversal, a model where the curriculum was shaped centrally and disseminated to teachers at the periphery. The quality of implementation and its effect on pupils' learning was very much determined by the culture of the science department, the nature of the department team, their approach to corporate planning and the quality of the leadership shown by the Head of Department.

The research concludes by highlighting that the implementation was impeded by the poor communication of the vision from the centre to the periphery and this was because, to some extent, central bodies were confused about what they should be prescribing. Initially the intention of the government was to prescribe and lay down by statute the content and nature of the curriculum, that is, the "what" of the curriculum rightly leaving the "how", the methodology for teachers to decide. It would seem from the research that those responsible for communicating the vision of the curriculum were unclear about this point and there were many attempts to influence how the prescribed curriculum should be taught. Ultimately, curriculum development is about teacher development and this is the challenge for the next five years to organise and support a system of teacher development which recognises that educational change is a complex phenomenon but in the final analysis educational change is an individual achievement. Lifelong learning for teachers and pupils must be the priority.
The Implementation of the National Curriculum Science  
Key Stage 3 - Six Case Studies  

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### Abbreviations

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<td>APU</td>
<td>Assessment of Performance Unit</td>
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<td>AT</td>
<td>Attainment Target</td>
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<td>CAB</td>
<td>Curriculum Advisory Board</td>
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<td>CATs</td>
<td>Consortium on Assessment and Testing</td>
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<td>CLIS</td>
<td>Children’s Learning in Science Project</td>
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<td>CSE</td>
<td>Certificate of Secondary Education</td>
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<td>CEI</td>
<td>Chief Education Inspector</td>
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<td>DES</td>
<td>Department of Education and Science</td>
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<td>DPSE</td>
<td>Diploma in the Practice of Science Education</td>
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<td>ERA</td>
<td>Education Reform Act 1988</td>
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<td>GASP</td>
<td>Graded Assessment in Science Project</td>
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<td>GCSE</td>
<td>General Certificate of Secondary Education</td>
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<td>HMI</td>
<td>Her Majesty’s Inspectors</td>
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<td>HOD</td>
<td>Head of Department</td>
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<td>KS3</td>
<td>Key Stage 3</td>
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<td>LAPPs</td>
<td>The Lower Attaining Pupils Project</td>
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<td>LEA</td>
<td>Local Education Authority</td>
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<td>LMS</td>
<td>Local Management of Schools</td>
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<td>MSC</td>
<td>Manpower Services Commission</td>
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<td>National Curriculum Council</td>
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<td>NEDC</td>
<td>National Economic Development Council</td>
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<td>Non-Statutory Guidance</td>
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<td>OFSTED</td>
<td>Office for Standards in Education</td>
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<td>PC</td>
<td>Profile Component</td>
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<td>Programme of Study</td>
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<td>SEAC</td>
<td>School Examination and Assessment Council</td>
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<td>SoW</td>
<td>Scheme of Work</td>
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<td>SSCR</td>
<td>School Science Curriculum Review</td>
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<td>SWG</td>
<td>Science Working Group</td>
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<td>TA</td>
<td>Teacher Assessment</td>
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<td>TES</td>
<td>Times Educational Supplement</td>
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<td>TGAT</td>
<td>The Task Group on Assessment and Testing</td>
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<td>T and L</td>
<td>Teaching and Learning</td>
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<tr>
<td>TVEHI</td>
<td>Technical and Vocational Education Initiative</td>
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<td>W</td>
<td>Working towards Level 1</td>
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Introduction

The Education Reform Act (ERA) of 1988 meant that for the first time pupils in England and Wales would be taught a nationally prescribed curriculum. In order to determine the nature of the curriculum it was decided to plan the curriculum on the basis of ten separate subjects by setting up subject working groups which would put forward proposals for programmes of study and attainment targets by which the curriculum would be assessed.

This was a radical shift in the educational system and it meant that the traditional autonomy of teacher and schools would in future be seriously constrained. This was a source of considerable anxiety to teachers. In addition to the curriculum being prescribed the Act also set out the mechanism by which the curriculum would be assessed and one of the emphases was that teachers would be more accountable and that schools should be able to demonstrate that they were giving value for money. Accountability and “value for money” were particular hallmarks of the Thatcher approach to Government.

The Science Working Group which was responsible for much of the shape of the first Orders for National Curriculum Science (1989) managed to allay many of the anxieties of the teaching profession by proposing an evolution of the curriculum based on current best practice. Similarly, the group appointed to advise the Secretary of State for Education on how the curriculum should be assessed, TGAT, placed their emphasis on the formative nature of assessment and again managed by their approach to maintain the confidence of the profession.

This study is therefore predominantly about that change. The essence of the change was a reversal of the process of curriculum development from the periphery, where science teachers decided and influenced central bodies to a centre to periphery model. Chapter one of this study looks at how the climate for change was created during the period from James Callaghan’s famous Speech in 1976 until the passing of the Education Reform Act in 1988.
Chapter two looks at how the Science Working Group and the Task Group in Assessment and Testing shaped the proposals for the Science National Curriculum and its assessment. In particular it notes how science teachers became involved in the early stages of the change process by the opportunity to be involved in the consultation process at the SWG Interim Report and Final Report stages.

In Chapter three the local substrata on which the change was to be built was considered and much of the study revolves around the Borough’s Curriculum document and its approach to assessment. The Annual Reports of the Chief Inspector, with particular reference to science, in the period just preceding the implementation of the National Curriculum, are drawn upon to show the state of readiness of the schools within one LEA to an innovation of the scale of the National Curriculum.

By the time the National Curriculum Science reached the Final Orders Stage it was a product of the visions of many different groups and at this stage it was essential to communicate to teachers the vision of the curriculum and to provide support and guidance for teachers. An attempt to communicate this vision was made by deluging schools with a variety of documents and in Chapter four the contents of these documents are discussed.

All successful change requires an individual response. Often the experience of change is individually threatening and disconcerting, which is why we need organisation settings in schools which supports teachers and students in the process of change

(Hopkins, Ainscow and West, 1994 p.41)

And so it was decided to study the way in which the National Curriculum Science at Key Stage 3 was being implemented during the period 1989 - 1992 by studying a representative sample of schools within one LEA and Chapter five outlines the approach taken to the research.

A case study approach was used so that findings within these schools could be relateable to other schools within the LEA and also nationally.
In Chapter six schools understanding and schools visions of the changes required were examined by considering how schools ensured continuity and progression of the curriculum from primary to secondary school how schools organised their schemes of work and how the pupils' work was assessed. Other aspects of the departments' work which contributed to what has become known as "professional judgement" were also researched.

Chapter seven examines the change process more closely (Everard and Morris, 1985) and relates the approaches of the various schools to stages in the change process and the cultures of the different departments (Hargreaves Andy, 1991, 1992, 1993)

In Chapter eight conclusions are drawn from the case study schools about the progress of the implementation of the National Curriculum Science and it looks at the aspects of policy and practice which either impeded or aided the process of change.
CHAPTER ONE

Creating the climate for change

Preview.

The National Curriculum was introduced to pupils aged 5 and 11 in the three subjects of English, mathematics and science in 1989. This followed the enshrinining in law of the National Curriculum as part of the Education Reform Act 1988. This chapter looks at the way the climate for such a change was created and focuses on the period from 1976, when James Callaghan made his famous Ruskin speech, to the Education Reform Act of 1988. The seeds of the ERA were sown in 1976 and the Ruskin speech marked a turning point in the way education was viewed. It was clear that the time had come for greater power and choice for those other than teachers, who had an interest in education.

Following the Conservatives victory in the 1979 General Election, Sir Keith Joseph, the Secretary for Education, highlighted the education system deficiencies and this was catalytic in preparing public opinion for a radical change.

In the case of science, several documents were published implying dissatisfaction with science education and suggesting ways forward. These various documents shaped the thinking that led to “Science 5-16 - A Statement of Policy” which acknowledged the existence of a climate for change in science education. It was in this document that the idea of a broad, balanced science education should be the entitlement of all, was declared. This document was very influential in developing schools' thinking about the science curriculum and it certainly laid the foundations for the introduction of Science in the National Curriculum in 1989.

Preparing the way for the New Curriculum - the Ruskin Speech 1976 to the Education Reform Act 1988 with particular reference to Science Education

The Education Reform Act (ERA) of 1988 was the most radical and important education law since the Education Act of 1944 because it

- increased the powers of the Secretary of State for Education and Science
set up the apparatus for enforcing and exercising these powers and responsibilities.

It strengthened central government’s role in education whilst introducing considerable limitations on the functions of the Local Education Authorities (LEAs). Kenneth Baker made it clear in his opening speech in the second debate in the House of Commons on 1 December 1987 that the Act was intended to mark a radical shift in direction. He felt it was time to

“inject a new vitality in the system that had been instigated by R.A. Butler’s Act of 1944.”

He considered that education had become “producer dominated”.

(Callaghan, J. 1976)

More than ten years earlier the then Prime Minister, James Callaghan, in his speech at Ruskin College on the 18 October 1976, had voiced the same charge of producer-domination with a stern warning:

‘to teachers I would say that you must satisfy parents and industry that what you are doing meets their requirements and the needs of their children. For if the public is not convinced then the profession will be laying up trouble for itself in the future’.

(Callaghan, J. 1976)

These words were regarded as marking the end of a post-war era where education philosophies were to be replaced by a more pragmatic set of views. He continued, and said

“We spend £6 billion a year on education, so there will be discussion. I repeat that parents, teachers, learned and professional bodies, representatives of higher education and both sides of industry, together with the Government, all have an important part to play in formulating and expressing the purposes of education and the standards that we need.”

(Callaghan, J. 1976)

It was in this speech that Callaghan noted in particular that “a high proportion of girls abandon science before they leave school and further,
"it is not my intention to become enmeshed in such problems as whether there should be a basic curriculum with universal standards - although I am inclined to think that there should be what I am saying is that where there is legitimate public concern it will be to the advantage of all involved in the education field if these concerns are aired and shortcomings righted or fears are put to rest. “

(Callaghan, J. 1976)

Maclure writing in “Education Reformed” says that the

"the speech served notice on the educators... that the Government had serious doubts about what the schools were doing, and intended to clear up these doubts even if this meant invading areas which the teachers thought were their territory.”

(Maclure, 1989 p.163)

Callaghan had three criticisms:

- education as preparation for work;
- teaching methods and the curriculum;
- teachers and their professionalism.

In focussing on education as preparation for work, Callaghan was concerned about poor standards, a criticism also voiced by employers, he wanted to encourage a switch from the Arts and pure Science to technology and he was also concerned about the lack of enthusiasm for jobs in industry. Perhaps, most significantly in the light of the Education Reform Act, he emphasised the need for teachers to show greater willingness to share curriculum concerns with parents and the public - to be more accountable for their work. The Great Debate, which followed Callaghan’s Ruskin Speech formally acknowledged that

"the post-war educational hypotheses were to be replaced by a different, less generous, perhaps more realistic, certainly more utilitarian set of views”.

(Maclure, 1989, p.159)

So in 1976 with this charge by James Callaghan that teachers had too much influence on education, the impetus for change had begun. There then followed a series of other influences which led to the Education Reform Act of 1988.
From 1976 until 1985 when Sir Keith Joseph published "Better Schools," the Department of Education worked slowly and steadily on the agenda set out by Callaghan. Two political Scientists at the University of Sussex, Ted Tapper and Brian Salter, noted that a departmental view was emerging from the DES.

"The Department took the opportunity which arose in the mid 1970's to take an active role in areas where it had previously had to tread very carefully. The policies which DES officials put forward in 1976 formed a package which ministers adopted and were sustained over time by successive Secretaries of State who had nothing better to put in its place."

(Maclure, 1989, p.164 - 165)

The Conservatives won the General Election 1979 and when Sir Keith Joseph took up post as Secretary of State for Education in 1981 he was committed to applying to education the government's radical economic policies. He wanted to instigate reforms which would increase parental choice and make the education system responsive to competition and market forces. Sir Keith Joseph proposed a voucher scheme which he thought would be capable of revolutionising education and providing a short-cut to higher standards by giving more power to parents as consumers. However, by the General Election of 1983, Civil Servants had convinced Sir Keith that there were too many practical difficulties to overcome and so the idea of vouchers was dropped, as at this time other reforms were underway - the new GCSE, the overhaul of teacher training, a new teacher's contract and an appraisal scheme for teachers. He was also working closely with the Manpower Services Commission in the Technical Vocational Education Initiative (TVEI) and he was expressing concern about the provision for the bottom 40% of the school population.

So, it was Sir Keith Joseph who turned the views expressed by Callaghan into action. By drawing attention to some of the difficulties within the educational system such as the inappropriate provision for the bottom 40% of pupils, the problems schools had with ineffective teachers they seemed reluctant to sack and the low expectations teachers held of some of their pupils. He prepared public opinion for radical change but in so doing he angered teachers and the Local Education Authorities. In addition, critics of education on the right were trying to show that standards had fallen because of the ideology of the progressives with their suspicion of both elitism and excellence. However, they were thwarted because the examination statistics showed that the number of students achieving examination success had continued to rise as a proportion of the age group. These critics did not get their evidence until 1983 when Professor Sig Prais published a paper on mathematics standards, comparing levels of
performance in England and the Federal Republic of Germany. Professor Prais concluded that German students in the bottom half of the ability range achieved average levels of performance compared with the average for the whole range of ability in England and Wales. The Prais evidence showed that the performance of English boys and girls compared badly with that of German boys and girls. Professor Prais attributed the superior performance of German students to their clearly defined, more sharply focused, programmes of study and fewer teacher/LEA variations from school to school and area to area. Inevitably this added fuel to the idea of an education system in crisis and gave further support for a National Curriculum. (Maclure 1989)

In the decade before the introduction of the Education Reform Bill, the DES and successive Secretaries of State showed increasing interest in the Curriculum and began to produce a series of policy documents such as the Organisation and Content of the 5-16 Curriculum 1984 and Science 5-16 - A Statement of Policy. In Curriculum Issues 5-16 DES. HMSG (1985) it is suggested that the design of the Curriculum be viewed from two essential and complementary perspectives. First, areas of learning and experience and second, elements of learning, that is, the knowledge, concepts, skills and attitudes to be developed. It is acknowledged that there are some essential issues which are not necessarily contained within subjects, but which need to be included in the curriculum. These are areas such as:

- environmental education;
- preparation for the world of work;
- careers education and guidance;
- equality of opportunity and multi-cultural education.

It then went on to say that the curriculum of all schools should involve pupils in the following areas of learning and experience:

aesthetic and creative;
human and social;
linguistic and literary;
mathematical;
moral;
physical;
scientific;
spiritual;
technological.
These were not suggested as discrete elements to be taught separately and in isolation from one another, rather, they contribute a planning and analytical tool and they are not equated with particular subjects, although inevitably individual subjects contribute more to some areas than to others. The document suggested that schools should ensure that, however the work of pupils is organised, each of the above areas of learning and experience is represented sufficiently for it to make its unique contribution. Schools were encouraged to examine existing practice to establish the extent to which particular topics, aspects and subjects were already contributing to these areas and to the development of knowledge, concepts, skills and attitudes. Thus whilst the document recognised the holistic nature of the curriculum it could also be considered to fall into the trap of defining the curriculum in subject terms.

In the education debate of the 1980s the rhetoric had changed from a concern with “the whole person” and “education for life” to a much more sceptical insistence that education must be useful in some directly marketable way - producing employable skills or nationally-needed expertise or character attributes required by industry or commerce. This insistence that education must be useful is most clearly exemplified by the aims of the Technical and Vocational Educational Initiative - which was announced by the Prime Minister in the autumn of 1982 with the aim, “of stimulating technical and vocational education for 14-18 yrs old across the ability range within the education system” to explore and test ways of organising and managing the education of 14-18 yrs old pupils across the ability range so that:

i) more or them are attracted to seek the qualifications/skills which will be of direct value to them at work and more of them achieve those qualifications and skills;

ii) they are better equipped to enter the world of employment which will await them;

iii) they acquire a more direct appreciation of the practical application of the qualifications for which they are working;

iv) they become accustomed to using their skills and knowledge to solve the real world problems they will meet at work;

v) more emphasis is placed on developing initiative, motivation and enterprise as well as problem-solving skills and other aspects of personal development;
vi) the construction of the bridge from education to work is begun earlier by giving these young people the opportunity to have direct contact and training/planned work experience with a number of local employers in the relevant specialisms;

vii) there is close collaboration between local education authorities and industry/commerce/public services etc. so that the curriculum has industry's confidence.

The TVEI had arisen directly out of the personal intervention of Mrs Thatcher. Following a meeting of NEDC in November 1982 the Prime Minister had within days and with the agreement of Mr David Young, Chairman of the MSC, allocated £7 million for 10 pilot projects in TVEI (TES 1982).

Mrs Thatcher, as a former Secretary of State for Education, knew she was cutting through or ignoring the red tape. Until this time the DES had a very different tradition of governing by consultation and, where possible, consent, through partnership with the LEAs and the teachers' unions. Sir Keith Joseph called TVEI an experiment, the seeds of which he hoped would carry throughout the education system. The 1984 white paper “Training for Jobs”, stated the intention of extending and developing TVEI.

Since 1945 there had been many attempts to establish systematic industrial training in Britain. There was no doubt about the need for such training but the successive Acts had little effect. The Employment and Training Act of 1973 set up the Manpower Services Commission with the funding and the ability to get some action by the end of the 1980s. TVEI had been a major force in curriculum development. (See DPSE 03 2(k) a). Many LEA's regarded TVEI roles as “about whole-curriculum change for all students 14-19 in every secondary school and college within the LEA” (Cooper, 1988. Management development for the extension of TVEI (Cardiff TVEI Unit)).

Shipman acknowledges that TVEI

“had many critics who saw it as an attack on a liberal education. But it had achieved a momentum beyond that of any other curriculum development aimed at the older secondary pupil.”

(Shipman, 1990 p.90)
In 1985 in the publication of "Better Schools", the government stated that it had no intention of introducing legislation re-defining responsibilities for the curriculum. Shortly after, Kenneth Baker took over from Sir Keith Joseph and in the early summer of 1986 he had begun to move towards a centrally controlled curriculum.

Science Education during this period

What of Science Education during this period? In "Science Education in Schools" published in 1982 it was proposed that science education should be regarded as a continuum from 5 to 16. It said that throughout the period of compulsory secondary education every school should adopt the policy of giving all pupils a broad science programme which moreover:

- allows the highest existing standards of science education to be maintained;
- caters fully for pupils who will be unable to reach these standards;
- and gives genuinely equal curricular opportunities in science to boys and girls.

Following the publication of "Science Education in Schools" a number of other important developments took place at national level such as

- decisions about the future organisation of examinations at 16+.
- approved and published national criteria for GCSE.
- The Royal Society published "Science Education 11-18"
- the Government offered LEAs grants from September 1984 to support in-service training for Science Co-ordinators in Primary Schools.

The TVEI, as already mentioned encouraged the uptake of double balanced science for all pupils and there were also projects such as the Micro Electronics in Education Programme, the Lower Attaining Pupils Project (LAPPS) and there was the developmental work being encouraged and disseminated by the Schools Science Curriculum Review (SSCR). It is against this background that the document "Science 5-16 - a Statement of Policy" was launched, which acknowledged that "not withstanding the inevitable constraints imposed by resource limitations there is a climate for change in science education”. The central objective of the national policy for science in secondary education in England and Wales is that all pupils should be given a broad programme of science well suited to their abilities and aptitude for the full five years of secondary schooling. A call was made in the policy to the School Science Curriculum Review (SSCR)
“drawing as it does on the energies of some 3000 Science teachers to demonstrate ways the principles can be put into effect!”

(Science 5-16 1985 p.19)

The document set out ten principles for science education,

- breadth
- balance
- relevance
- differentiation
- equal opportunities
- continuity
- progression
- links across the curriculum
- teaching methods and approaches and assessment

and it was declared in the policy “that the implementation of these principles would represent for many pupils a substantial advance over the science education which is at present offered”. The policy was published as a statement of policy for science education in schools for the compulsory period and as a contribution towards the definition of more detailed objectives in that field as a means towards improving the performance of pupils.

The National Curriculum, which had originally been regarded as a highly controversial idea in early 1980's, figured largely in the Conservative Party manifesto at the General Election of June 1987. It had a wide measure of support outside the Conservative Party and the debate was not now on whether there should be a National Curriculum but on how it should be set up and how it could be assessed. The 1988 Act clarified that the legal control of the curriculum lay with the Secretary of State, in the 1986 Act there had been an insistence that both the local education authority and the governing body must adopt curriculum policies to give effect to the National Curriculum.

The 1988 Act with regard to the National Curriculum required the Secretary of State to set up the mechanism to produce the Programmes of Study, Attainment Targets and procedures for Testing and Assessment. To achieve this he set up working groups to prepare the Programmes of Study and Attainment Targets, subject by subject, for the ten-subject curriculum laid down in section 3 of the Act. The
Secretary of State was also required to set up and keep in being a National Curriculum Council (NCC) and Schools Examination and Assessment Council (SEAC).

Summary of Chapter One

This chapter discussed how the climate was created from the period 1976 until 1987 which led to the National Curriculum.

The ERA of 1988 arose out of developments which had begun when James Callahan made his famous Ruskin Speech in 1976 in which teachers were criticised for being too dominant in the educational debate and called for the greater accountability of teachers, accompanied by a drive to improve standards. During the period from 1976 to 1988 successive Secretaries of State for Education worked on the agenda set out by Callaghan until 1988 when the Education Reform Act was passed in parliament. This was the most far reaching and important Education Act since 1944.
CHAPTER TWO

Shaping the change

Preview

The National Curriculum in Science was first implemented at Key Stages 1 and 3 with effect from the first of August 1989.

The main theme of this chapter is to look at how those final orders were shaped and how the process helped in preparing teachers for change and particularly considers the influence of

- The Science Working Group’s (SWG) Interim and Final Reports.
- The response to these documents following the period of consultation.
- The Task Group on Assessment and Testing (TGAT).

It also asks why, before there had been a first full run through of the Science Curriculum of Key Stage 3, it was considered necessary to revise the Statutory Orders.

During the period from the setting up of the SWG - until the Orders for Science were revised an enormous number of documents were produced. Some of these are drawn upon during this chapter and they will be discussed in order outlined below:

- The terms of reference of the Science Working Group as set out by the Secretary of State for Education.
- A letter from the Secretary of State giving further details of the terms of reference.
- The membership of the Science Working Group.
- The response to consultation on the Interim Report.
- The response to the consultation on the Final Report.
- The brief of the Task Group on Assessment and Testing.
- The Science Orders.
- Duncan Graham’s book “The Making of the National Curriculum A lesson for us all”
- HMI reports on the first and second year of implementation of Science in the National Curriculum.
- The revision of the Science Orders.
The Science Working Group (SWG) was set up by the Secretary of State for Education and Science in July 1987 with the sort of representation of interests highlighted by James Callaghan in his Ruskin Speech of 1976. The purpose of the working group was to recommend Attainment Targets (ATs) and Programmes of Study (PoS) for Science.

The science working group was initially required to report by the 30 November 1987 on

- the contribution of science to the whole curriculum
- the knowledge, skills and understanding which pupils should be expected to demonstrate at age 7, 11, 14, and 16
- a programme of study for age 5 to 16

and to make initial recommendations about assessment, particularly what might appropriately be measured by externally set tests.

In the September of 1987 the remit of the working group was extended to include technology at the primary level.

The group was aware of breaking new ground and they aimed to build on existing good practice taking into account the DES Policy Statement Science 5-16 and other work including the policy statement from the Association for Science Education and the work of the Secondary Science Curriculum Review (SSCR) as well as the draft criteria for the GCSE Sciences: Double Award.

At the same time, another group, the Task Group on Assessment and Testing (TGAT) was set up to make recommendations to the Secretary of State about how teachers accountability could be addressed through the processes of assessment and testing.
Timeline

- July 1987 Science Working Group set up.
- December 1987 Task Group on Assessment and Testing present their report.
- August 1989 - Statutory Orders for KS3 came into force.
- January 1991 - A review of the Orders for Science was announced.
- May 1991 NCC issued proposals to replace the 1989 order following a review of the attainment targets and a suggested reduction from 17 ATs to 5.
- NCC Consultation Report recommends that the five attainment targets in proposals to the Secretary of State should be reduced to four.
- December 1991 reviewed Orders laid before Parliament.
- June 1992 Pilot tests for end of Key Stage 3 Assessment in Science based on the new Orders.
- August 1992 revised Orders came into force.

The road to implementation of the Science National Curriculum

The reality of James Callaghan’s words were now felt by all concerned with education and it came as no surprise that the first working group set up was the science group. To some extent the membership of the group reflected Callaghan’s words

“that there would be discussion and that parents, teachers, learned and professional bodies, representatives of industry, together with the Government all have an important part to play in formulating and expressing the purposes of education”.

(Ruskin Speech, reprinted in Education)
through red tape as shown by the TVEI project probably encouraged the Government to push the working group to meet the deadline imposed.

The Science Working Group

In July 1987 Kenneth Baker set up the Science Working Group (see Appendix A for members of group) to recommend attainment targets and programmes of study for science within the framework of the proposed national foundation curriculum for pupils of compulsory school age in England and Wales.

In September 1987 the remit of the Group was extended to include technology at the primary level.

The first task of the group was to submit an Interim Report to the Secretary of State by 30 November 1987 outlining the following:

- the contribution of science to the overall school curriculum, as this would inform the Group’s thinking about attainment targets and programmes of study;

- the Group’s provisional thinking about the knowledge, skills, understanding and aptitudes which pupils of different abilities and maturity should be expected to have attained and be able to demonstrate at or around the end of the academic year in which they reach the age of (7,) 11, 14 and 16. (It was left open to the Group to recommend that a different age than 7 should be covered).

- their provisional thinking about the programmes of study from 5 to 16 which would be consistent with the attainment targets provisionally identified.

The Group was also required to make initial recommendations about assessment in relation to the attainment targets “and in particular what might appropriately be measured by externally set tests rather than other techniques of assessment.”

*For the full text of the Group’s terms of reference see Appendix B.*

The Science Working Group had an enormous task to do in a short time as the final report was to be submitted by 30 June 1988.

In the interim report the Working Group began with two key principles:
1. that science should be part of the “Whole Curriculum” that is broad, balanced relevant and differentiated

2. that science education should be concerned with the development of knowledge with understanding, scientific skills and attitudes.

(Interim Report of SWG, Dec 1987 p.6)

The first meeting of the working group was held at the beginning of September and they started by determining the path they proposed to follow in defining attainment targets and programmes of study.

The Group was well aware that it was

“breaking new ground and we have deliberately opted not to be too innovative and to build instead on existing good practice.”

(Interim Report, SWG 1987, p.6)

Despite the Government’s desire for radical change and to make teachers more accountable, from the outset the SWG took an evolutionary approach in building on existing best practice. It is here that perhaps the seeds for some of the later confusions were sown. The proposals took into account the DES policy statement “Science 5-16” and other work including the policy statement from the Association for Science Education, “Education through Science” and the “Better Science Guides” of the Secondary Science Curriculum Review as well as the draft criteria for the “Sciences : Double Award.”

In producing its framework the group stated that it had

“aimed to produce a framework that is simple clear and coherent whilst allowing full scope for the enterprise of teachers and schools.”

(Interim Report, SWG 1987 p.6)

This seems to be a reflection of the working groups expressed wish to build on existing good practice but it also highlights that those most centrally involved in shaping the change had not yet fully come to terms with the notion of the National Curriculum and its effects on constraining some of the traditional freedoms of teachers. From the earliest work of the SWG there are strong tensions between the Government’s wish to ensure greater uniformity and thus greater accountability and the SWG’s desire to build on best practice and to allow for teachers’ own creativity.
Teachers' own creativity and the Government's desire for greater accountability are
not necessarily mutually incompatible, to some extent understandably the Science
Working Group which had been asked to look at the "what" of the curriculum found
it difficult to resist from being drawn into discussion about the "how" of the
curriculum.

The Secretary of State for Education had informed the SWG that the Programmes of
Study should describe the content required to enable pupils to reach or surpass the
attainment targets. They should provide a detailed description of the content, skills
and processes that all pupils need to be taught, set within an overall or outline map of
the curriculum. This explanation of the purpose of the Programmes of Study was
crucial but was largely overlooked as schools started to implement the new
curriculum.

The Secretary of State advised the group that he expected the development of
attainment targets and programmes of study to be an iterative process.

The working group exemplified their approach by fig 1.

**Figure 1: Task Model**

![Diagram of Task Model](image)
The model illustrated the working group’s view that their approach was integrated and child-centred and maintains the emphasis on the whole child rather than the utilitarian view of education expressed by the politicians. They consider the following to be essential elements of learning in science:

- The knowledge and understanding which characterises a scientific way of looking at the world.
- The skills, or ways of working in science, through which knowledge is developed and tested.
- The attitudes which promote pupil involvement in science and encourage learning.

(Interim Report, SWG 1987, p.8)

Building on the principles already established in “Science 5-16: A Statement of Policy” the working group also made it clear that they

“were anxious to reduce the present disjunction between the primary and secondary places of education and to promote continuity and progression throughout”.

(Interim Report SWG 1987, p.8)

The Interim report of the Science Working group was published in December 1987 and in setting out the Programmes of Study the group proposed it should have two elements:

- a broad overall map of the science curriculum 5-16, indicating lines of development in knowledge and understanding, skills and attitudes;
- a more detailed interpretation of this outline at each stage for age ranges 5-7, 7-11, 11-14 and 14-16.

(Interim Report SWG 1987, p.9)

The group had mapped out scientific knowledge and understanding within a number of main themes and sub themes and presented four of these themes as shown in table 1. (page 19)
The group noted that a fifth theme, which could involve aspects of earth science and astronomy, was still under review.
### TABLE 1

**TITLES OF SCIENCE THEMES AND SUB-THEMES 5-16**

<table>
<thead>
<tr>
<th>1</th>
<th>LIVING THINGS AND THEIR INTERACTION WITH THE ENVIRONMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>The diversity of life.</td>
</tr>
<tr>
<td>1.2</td>
<td>The relationships between organisms, habitat and the environment.</td>
</tr>
<tr>
<td>1.3</td>
<td>Plant nutrition and its role in sustaining life.</td>
</tr>
<tr>
<td>1.4</td>
<td>Ecosystems.</td>
</tr>
<tr>
<td>1.5</td>
<td>The organisation of living things and the processes which characterise them.</td>
</tr>
<tr>
<td>1.6</td>
<td>Scientific aspects of human health and well-being.</td>
</tr>
<tr>
<td>1.7</td>
<td>Reproduction, development and growth.</td>
</tr>
<tr>
<td>1.8</td>
<td>Inheritance, selection and evolution.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2</th>
<th>MATERIALS AND THEIR CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>The diversity of natural and manufactured materials.</td>
</tr>
<tr>
<td>2.2</td>
<td>Different classifications of substances.</td>
</tr>
<tr>
<td>2.3</td>
<td>The process of changing substances by chemical reaction.</td>
</tr>
<tr>
<td>2.4</td>
<td>Using models to explain the behaviour of substances.</td>
</tr>
<tr>
<td>2.5</td>
<td>The manufacture of materials from available resources.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3</th>
<th>ENERGY AND MATTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Energy changes associated with changes of temperature and state.</td>
</tr>
<tr>
<td>3.2</td>
<td>Energy in action.</td>
</tr>
<tr>
<td>3.3</td>
<td>The forms, transfer, transformation, degradation and conservation of energy.</td>
</tr>
<tr>
<td>3.4</td>
<td>Global energy resources.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4</th>
<th>FORCES AND THEIR EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Forces and their effect on movement.</td>
</tr>
<tr>
<td>4.2</td>
<td>Forces and their effect on matter and structures.</td>
</tr>
<tr>
<td>4.3</td>
<td>Electric and magnetic forces and fields.</td>
</tr>
<tr>
<td>4.4</td>
<td>Forces and machines.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5</th>
<th>THE EARTH, ATMOSPHERE AND SPACE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(under review)</td>
</tr>
</tbody>
</table>
Attainment Targets, like the Programmes of Study were considered to stem from the lines of development for knowledge and concepts, skills and attitudes. It was at this stage that the group suggested age-related attainment targets but they were keen to point out that they were progressive in nature and thus built on each other. To accommodate the different rates at which children will make progress towards attainment targets, they proposed to identify differentiated levels of attainment within attainment targets.

The various stages of reports and consultations helped to prepare teachers for the change involved in implementing the National Curriculum - although age-related ATs were later scratched, at least one of the case study schools held on tenaciously to the view that level 3, for example, was different at each Key Stage.

Shortage of time for assessment prevented the group from exploring fully the implications of their proposals, but they had initial discussion with Professor Black, Chairman of the Task Group on Assessment and Testing, which had been set up at the same time. The working group did however, express its commitment to an assessment process which was curriculum-led.

The view of science education that the group adopted was influenced strongly by the work of the "Children's Learning in Science Project" and is based on the view that:

"a child brings ideas of his or her own to the classroom or laboratory, and the aim of science education is then to adapt or modify their original ideas so as to give them more explanatory power."

(Interim Report SWG, 1987 p.18)

In developing attainment targets and programmes of study, the group found it helpful to identify three distinct but inter-dependent aspects:

i) The knowledge and understanding which characterise a scientific way of looking at the world.

ii) The skills which characterise the ways of working in science.

iii) The attitudes which are necessary, in order to provide scientific ways of thinking and working.
Figure 2 below showed how the development of these aspects linked to learning experience. This showed that knowledge and understanding derived from a number of related experiences, that skills are developed through the use and extension of a greater range of experiences, and that attitudes are also widely related to experiences.
Whilst establishing Programmes of Study and Attainment Targets, the working group left the selection of learning activities very much to the individual teacher but did set out criteria by which the selection of learning activities should be made.

Will the experience:

- stimulate curiosity?
- give opportunity for developing scientific and technological skills?
- give opportunity for developing attitudes relating to scientific and technological activity including curiosity and co-operative working?
- give opportunity for developing basic science concepts?
- relate to the interests of children at a particular age and to their everyday experiences?
- appeal to both boys and girls and to those of all cultural backgrounds?
- help children understand the world around them through their own mental and physical interaction with it?
- involve the use of simple, safe and familiar equipment and materials?
- involve resources and strategies accessible to all teachers?
- give opportunities to work co-operatively and to communicate scientific ideas to others?
- contribute to a broad and balanced science curriculum, bearing in mind other experiences already selected?

(Interim Report SWG 1987, p.28)
The science working group also spelt out that pupil’s learning should be grounded in first hand experiences and said that:

“pupils will need to be given opportunities to extend their knowledge of phenomena, to test out ideas experimentally, to develop practical skills and collaborative approaches to problem-solving.”

(Interim Report SWG 1987.)

The group outlined what pupils should be able to do as a result of investigational work in the themes and sub-themes.

* Explore events and phenomena seeking regularities and noting the unexpected.
* Formulate hypotheses which can be tested experimentally.
* Plan and carry out investigations using apparatus, materials and methods appropriate to the problem being investigated.
* Make and systematically record observations which are relevant to the problem being investigated.
* Represent experimental findings using graphs, tables, charts, symbols and conventions as appropriate.
* Select measuring instruments which are suitable to a task and use them to an appropriate level of accuracy.
* Recognise variability and unreliability in measurements.
* Make references and justify them in the light of data.
* Evaluate the design of experiments.

Furthermore, in order to undertake practical investigations in a competent and safe way pupils should be able to:

* Use a range of measuring instruments.
* Estimate quantities.
- Follow instructions in verbal and written form.
- Work with an awareness of safety aspects.
- Treat living things with respect.

The working group in the interim report also suggested that pupils should show an understanding of, and use, scientific concepts and models and outlined what pupils should be able to do. Similarly, the working group stated that pupils should also as they get older understand the place of science in society and in this context outlined what pupils should be able to do. Additionally, the working group also stressed the importance of communication and social skills, and the science curriculum should encourage the following attitudes:

**Attitudes**

- Curiosity and a sense of wonder and excitement at the physical and natural world.
- Appreciation of the excitement of scientific discovery.
- Respect for the environment and for living organisms in particular.
- A responsible attitude to safety, particularly relating to laboratory practice.
- Readiness to search for patterns and to put them to the test.
- Appreciation of investigational methods, the tentative nature of scientific truth, the powerful process of falsifying models have become refined in the light of new evidence.
- Willingness to appraise and use scientific evidence, leading to the formation of a balanced judgement.

It should also encourage the following attitudes to science as a way of seeing the world.
• Appreciation that science can make important contributions to other areas of learning, and that scientists derive knowledge, skills and inspiration from non-scientific activities.

• Appreciation of the relevance of science to every day, and readiness to recognise potentially useful applications of science.

• Appreciation of the contribution that the application of science makes to the quality of their own and other people's lives.

• Awareness that application of science in society may cause difficult moral dilemmas.

Response to the Interim Report

Respondents commented on several aspects but particularly

• Broad and balanced science for all up to 16.

• Continuity between primary and secondary schools.

• Demands made on pupils to recall information.

• Theme maps.

• Science/industry links.

• Problem solving.

• Information Technology (IT).

• Health Education.

• Attainment Targets and Programmes of Study.

• Assessment.

The tenor of the respondents to each of these areas is included below.
The interim report was published for consultation in December 1987.

See Appendix D - for PoS and ATs for 11-14

The report was welcomed by many in supporting broad, balanced and differentiated science for all children up to the age of 16 and there was also endorsement for the emphasis placed on science in the whole curriculum and the importance of developing children's first hand experience.

In relation to continuity between primary and secondary phases the group was urged to give more thought to the relationship between the primary and secondary programmes.
Respondents also commented on the working group's idea of progression but added a caution that progression was not necessarily linear. The group was therefore advised to seek a simpler approach which would allow the lines of development to be set out in levels.

Greater clarity was called for in the working groups intention on the demand for pupils to recall information and the group was reminded of the work of the Assessment of Performance Unit (APU) that children were not very good at demonstrating conceptual understanding of science, and that there was strong evidence that context had an effect on performance.

Many comments were received about the theme maps, some welcomed them, others thought that there was not sufficient distinction between the scientific disciplines and that chemistry was in danger of being under-valued. The inclusion of the Earth Sciences within the science document was generally endorsed. There was also a reminder to the working group that whilst science should be used not only to understand and explain, but also to help effect action and to produce results, scientific skills and areas of knowledge inevitably need to be brought to bear in technological tasks. Many respondents hoped that with regard to science education/industry links that there would be positive encouragement for schools and teachers to invite local industrialists to discuss the importance and role of science in the economy, it was also hoped that children, through their study of science would see how science was being used to create new products, and hence new jobs for their parents and themselves. To some extent here again we see the tension between the "what" of the curriculum and the "how," as the Working Group was also asked by respondents to take account of the following in their final report:
i) References to 'problem solving' should make clear that problems should as far as possible be real; some teachers' schemes of work might be developed with industry.

ii) The need to encourage information technology awareness and the teaching of IT skills.

iii) The importance of economic awareness and the need to develop it as a significant cross-curricular theme within the science and technology curriculum.

iv) The value of science teachers developing cross-curricular activities involving one or more other subjects; and

v) The need to stress that good communication skills are as important in science and technology as in the English curriculum.

In addition

The Working Group was encouraged to inter-weave environmental education within the framework for the science curriculum.

The Working Group received support for its approach to Health Education in the Interim Report with the hope that the final report would stress the importance of developing in children the ability to understand the consequences of action for self and others.

The concept of the National Curriculum was innovative, and the Science Working Group suffered from having an almost empty page to write. Inevitably, there was pressure to make the Science Curriculum all embracing.

With regard to pupils with individual needs the general approach in the Interim Report was welcomed. The group was also reminded to consider how the science curriculum could encourage children with learning difficulties whilst also meeting the needs of the very able child.

Additionally, the working group was encouraged to be mindful of the ethnic and culturally diverse nature of British Society and to ensure that the science curriculum reflected this richness.
Response to the proposed Attainment Targets and Programmes of Study

The inclusion of exemplar attainment targets was welcomed but it was felt that a number required greater clarity if teachers were to work with them. It was also felt that the Programmes of Study needed to include the kinds of experiences children should have in order to develop the knowledge, understanding, skills and processes in the attainment targets. There was general agreement that the number of attainment targets should be limited to avoid overloading teachers. In their Interim Report the Science Working Group was at pains to hold the faith of the Science Educators. Their proposals were largely welcomed and allayed some of the concerns many had about the concept of a National Curriculum. It would seem from the evidence of the Interim Report that there was a strong possibility that the vision of the curriculum held by the SWG was not completely congruent with that of the politicians.

Assessment - Science Working Group early recommendations

The Government had made it clear that assessment was to be a major plank in increasing the accountability of teachers and so the assessment of the science curriculum also was the subject of many responses. The responses to the report particularly highlighted that there was a tension between validity and reliability. It was felt that reliability involved a certain level of specificity which could be too burdensome on teachers and pupils and might lead to teaching to the test. Emphasis on validity might lead to an approach which would be of little value diagnostically. There were also comments received about a possible tension between internal and external moderation. It was suggested that standard assessment tasks should only be used to moderate school assessment and be applied to a sample of pupils to standardise the group.

Despite the work of the SWG, almost from the beginning there appeared to be a sharp division between curriculum and assessment.

All teachers recognise that effective learning cannot take place without on-going (formative) assessment but minds were being concentrated at this stage on the issue of assessment for accountability purposes.

- respondents also felt that the distinction between the purposes of formative and summative assessment were not made sufficiently clear.
Many also called for trialling and phasing in of assessment instruments, and adequate time for in-service training.

The split between curriculum and assessment was further reinforced because whilst the Science Working Group was working on the interim report, a second group called the Task Group on Assessment and Testing (TGAT), under the leadership of Paul Black, was looking at the issues with regard to assessment and testing and their report was published at about the same time as the Science Working Group.

In terms of accountability what the Government certainly had in mind was tests at age 7, 11, 14 and 16, which would be like dipsticks to show the standards pupils achieved nationally at these points and to provide parents with information about how their children are doing compared to other pupils of the same age. The Government possibly at this stage considered the use of tests somewhat similar to those used for some years in Croydon.

**Task Group on Assessment and Testing (TGAT)**
**Report published 24 December 1987**

"The Task Group on Assessment and Testing (TGAT), was set up by the Secretary of State to make recommendations about how children's performance and progress across the subjects of the national curriculum should be assessed and be reported to those with a right to know."

(The digest of the TGAT report 1987 p. 6)

**General points**

The Task Group considered that assessment policy should follow from decisions about the curriculum.

"Assessment methods are important in that they clarify curricular aims and provide the essential information about success in achieving these aims. Thus good curricular and assessment policies go hand in hand."

(TGAT Report 1988, p.6)

Like the Science Working Group, the recommendations of the Task Group were designed to make full use of the existing expertise and good practice in many schools. The Task Group proposed a system that was in the main, formative, in that it would provide information which would be of help in deciding how pupils' learning may be
taken forward, both individually and collectively. For pupils at the end of their compulsory schooling, the system would also be summative providing a comprehensive picture of the overall achievement of a pupil.

The Task Group proposed that the assessments used would be like teachers’ day-to-day assessments, that is, they would be directly concerned with what is being taught and their purpose would be to reveal the quality of each pupil’s performance, irrespective of the performance of other pupils. Their assessments would rely on clear descriptions of the performance being sought. That is, the assessments would be criteria-referenced rather than the norm-referenced tests which are used to compare children with each other.

The Task Group highlighted that the issue of manageability must be considered, particularly as progress may need to be assessed in aspects of nine or ten subjects. The Group introduced the idea that information about pupils progress would be easier to handle at reporting level, if different levels of achievement were given numbers or letters rather than having to spell out in detail what a pupil knows and can do. The Task Group proposed that the reporting system should use a scale of 1 to 10 to cover the full range of progress that children of different abilities made between the ages of 5 and 16. Each number was to represent a level of achievement. The levels would be specified so that it would represent the average educational progress of children over about two years. The idea was represented by figure 3, showing the sequence of pupils’ achievement of levels, between ages 7 and 16.
The bold line gives the expected results for pupils at the ages specified. The dotted lines represent a rough speculation about the limits within which the great majority of pupils may be found to be.

The group recommended that the ages for reporting for National Curriculum purposes should be 7, 11, 14 and 16. The ages were chosen so that children will normally have had at least two years in the school which reports upon their performance and progress. The Group stressed that the system must provide comprehensive and useful information to be passed from one school to the next.

In striving to ensure reasonable consistency of reporting from school to school, the group remarked that it would be necessary for some common agreement to be reached about how achievements are judged. The Group stressed that it would be wrong to do this by ignoring the assessments that teachers themselves make and rely entirely on an external system. The Group therefore recommended that assessments be made by combining teachers' own assessments with the results of externally provided tests.
Following discussion of the these general points, the TGAT then outlined its proposals for

- Task and Tests.
- The process of moderating results.

Tasks and Tests

The Government had clearly expressed its desire for “pencil and paper” tests as a major part of the accountability of schools. In contrast the Group said that the art of constructing good assessment tasks was to exploit all possibilities of presenting “questions” orally, in writing or through pictures and diagrams so that pupils are involved in mental work, speech, writing and many forms of practical activity. The Group acknowledged that “paper and pencil” tests have an important part to play but highlighted that where a greater variety of good tests is available, a pupil can have the opportunity to show his or her achievements in more than one way, and that it is possible to assess different aims by methods selected to reflect each one of them faithfully. (For further details of the tests for 7 and 11 yr olds see the Digest Page 12).

For the 14 and 16 year olds the Group recommended that subject-related tests would predominate.

The Process Of Moderating Results

With regard to the moderation of results, the TGAT recommended that when the tests have been completed teachers will have their own assessments of each pupil’s level of attainment and they will have the marks arising from the tests. Teachers from a group of schools would then attend a moderating meeting, bringing examples of children’s work. At secondary level this would involve teachers from a particular subject. The process would be more manageable in the early years of the system if one of the tasks is used in the classes of all teachers attending the meeting. The purpose to the meeting would be to compare the spread of results from the tests with the teachers’ assessments. The moderating group would need to consider any discrepancies and decide whether:

- differences can be explained by differences in the criteria used by particular teachers, so that the assessment of those teachers should be re-scaled;
there are some local factors, or other legitimate reasons in particular schools which can justify re-scaling to national assessment results;

there seems to be something amiss with the overall results of the national tests rather than with the school assessments.

(TGAT 1988, p.13)

In all cases, the moderating group would have to reach a decision on a single distribution, combining internal and national results, for each school.

The final decisions about individual pupils would rest with the teacher. Such decisions would be made using all the information available, including the guidance given through the group moderation, and within the constraint that the overall distribution for the class had been settled by the moderation meeting. In making judgements the teacher would be exercising professional responsibility to provide as reliable a result as possible given that it would form the basis for discussions with parents, for decisions about the pupil's learning needs, and for appraising progress in future years.

At ages 7, 11, 14 or 16 parents would be told what levels their children had reached in the various profile components and what proportions of children in the age group reached the various levels achieved, both within the school and nationally.

In the digest the Group concluded by saying

"it had been in no doubt that a successful system of assessment depends upon teachers' confidence in it and their willingness to take responsibility for it. These requirements make it necessary that the system should support teachers' professional concern for the effectiveness of their teaching."

(TGAT 1988, p.17)

Despite the reservations and concerns of many teachers about the strictures of National Curriculum and Assessment Scheme, so far neither the Science Working Group or the Task Group on Assessment and Testing had said anything that teachers thought they could not live with. Both groups had given constant reassurances that they were building on good practice and that they were favouring a child-centred approach rather than the more utilitarian and accountable approaches favoured by the Secretary of State.

See Appendix D for full list of recommendations.
The TGAT had a vision of tests and tasks which were very much like current practice and would largely arise from day to day teaching and learning activities. The Government on the other hand was looking for tests which were simpler and which would be able to yield information about how pupils were doing nationally, and at LEA and school level. Once more, we see a lack of match between the visions of the Government and the vision of the Science Education Profession.


Following the period of consultation and continued work the final report of the Science Working Group was published in August 1988. They recommended 22 attainment targets in science for pupils aged 11 to 16 and 17 attainment targets for pupils aged 7 to 11. The attainment targets had been framed in broad terms so that each target at some level was within the grasp of children of different ages and abilities.

In knowledge and understanding, the group recommended that there should be 13 attainment targets for pupils aged 5 to 11, and 16 for pupils aged 11 to 16. In addition the group recommended two attainment targets for Exploration and Investigation for pupils aged 5 to 16, two in Communication for pupils aged 5 to 16 and two for Science in Action for pupils aged 11 to 16. The group recommended that the attainment targets should for reporting purposes be grouped into four profile components. (PC), Exploration and Investigation, Communication, Knowledge and Understanding Science in action and are shown in Table 2 below.

<table>
<thead>
<tr>
<th>Profile Component</th>
<th>Reporting Age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>7 11 14 16</td>
</tr>
<tr>
<td></td>
<td>% % % %</td>
</tr>
<tr>
<td>Knowledge and Understanding</td>
<td>35 35 40 40</td>
</tr>
<tr>
<td>Exploration and Investigation</td>
<td>50 50 30 25</td>
</tr>
<tr>
<td>Communication</td>
<td>15 15 15 15</td>
</tr>
<tr>
<td>Science in Action</td>
<td>- - 15 20</td>
</tr>
<tr>
<td>Total</td>
<td>100 100 100 100</td>
</tr>
</tbody>
</table>
The Science Working Group recommended that the targets in Exploration and Investigation, should be assessed by reference to the pupil's key stage. This would mean that being at level 5 could mean something quite different for two pupils in two different key stages. This was not what TGAT suggested.

Within the attainment targets, the SWG devised statements of attainment which described in greater detail and with more precision, what pupils should know, understand and be able to do at particular ages and stages.

In the final report the working Group restated that they believed

"that what we are recommending will be seen not as a radical new departure, but rather as a clearer and firmer framework for what many teachers in Science are already doing. In this way we believe that other science teachers will recognise our framework as one within which they are already aspiring to teach, even if they do not yet feel fully confident about dealing with all its aspects."

(Final Report SWG 1988, p.3)

In responding to the final report the Secretary of State commented on the Science Working Group’s recommendations in several areas. The Secretary of State concurred with the working group with regard “to the importance it attached to developing scientific skills through appropriate practical and investigative work and also in recognising the importance of ensuring that pupils are able to communicate effectively what they have done.” The Secretary of State also re-iterated that pupils should study science with reference to economic and social consideration, but the Secretary of State felt that the need for six attainment targets covering these areas should be the subject of consultation.

The Secretary of State also called for greater precision in the way in which these attainment targets were defined. The Secretary of State proposed that

“the attainment targets suggested by the group for exploration and investigation, communication and science in action should be re-examined and, where possible, should be combined with attainment targets for knowledge and understanding. “

(Proposals of the Secretary of State for Education and Science and the Secretary of State for Wales. NCC 1988, p. iii)

The Secretary of State was also concerned about the weighting of profile components which the group had suggested. The Secretary of State proposed that the profile components for science

“should not exceed two or three at the most. We further propose that the relative weighting of the profile components for knowledge and understanding should be considerably higher at each reporting age than suggested by the Group.”

(Proposals of the Secretary of State for Education and Science and the Secretary of State for Wales. NCC 1988, p. iii)

With regard to the Group’s proposal that the targets for exploration and investigation, communication and science in action should be assessed by reference to the pupil’s key stage, the Secretary of State said that this proposal if adopted would be confusing to teachers, pupils and parents and he proposed that the group’s recommendations be modified so that each level on the 1-10 scale, to be used as the basis for recording pupils’ achievement, specifies a unique standard of achievement irrespective of a
child’s age. It was at this point that the suggestion that some of the attainment targets should be age-related were scratched.

In their proposals the group had recommended that all pupils in years 4 and 5 (10 and 11) should study science for twenty per cent of curriculum time leading to a double GCSE Certificate. The Secretaries of States proposed

“that the science framework be further considered to identify the key elements for a worthwhile balanced science programme which some pupils might cover in about 12.5% of curriculum time in years 10 and 11, leading to a single GCSE Certificate.”

(Proposals of the Secretary of State for Education and Science.)

Duncan Graham said that when he

“first read the science report in my new guise as Chairman of the National Curriculum Council I was very concerned as a non-scientist that it was all things to all men. It was not entirely clear on the attainment targets and programmes of study but nevertheless it was supported by the consultation exercise enthusiastically and totally.”

(Graham 1993, p.38)

Graham also wrote about the twin problem of the argument surrounding dual science, the balanced course which carried two GCSE awards, and the continuation of the traditional three sciences of biology, chemistry and physics, and the amount of time science would occupy in the school week. A survey into GCSEs’ that was published while the Science Group was at work was damning, because it showed virtually nobody did all three sciences and that girls did biology while boys did physics. If there was a broad and balanced science education it was confined to a very small minority of the population.

Graham also pointed out how the science report made everyone aware of the overcrowding of the curriculum,

“When the science report was considered in the summer, the embryo NCC, the DES and HMI were all exercised not by the quality of the report but by its size and the implications that it had for teaching time. No matter how the sums were done up there was no way we could see that would allow the science report to be accepted in its entirety.”

(Graham 1993, p.39)
He goes on to say that Kenneth Baker, HMI, DES officials and himself all came independently to the conclusion that there might have to be two science courses, dual science to take 20 per cent of the curriculum time with a new single science course allotted 12.5 per cent of the time. The NCC had to then work out what a ‘single’ science course would contain and Jenny Hall from NCC and two HMIs, within the space of a few weeks, produced the new course. Their solution was to reconsider the full working group report and to produce a course based on the irreducible essentials. Graham said the proposal for a single science course

“was not popular with the people who replied to the consultation questionnaire, with nine out of ten being against it.” At this stage nobody had seen the detailed proposals because they were still being worked out, but the “concept drove the scientific community up the wall.”

(Graham 1993, p.40)

“Scientists did not want to see the introduction of what they believed would be a watered-down science course.”

(Graham 1993, p.41)

The issue was discussed at a meeting of the council and it was decided unanimously that there had to be two science courses. The National Curriculum Council asked Kenneth Baker (Secretary of State) to do all he could to encourage schools to develop courses leading to the dual award and offer it to the majority of pupils. It was later agreed that whatever else schools did they had to offer the dual course.

The NCC did some further work following the consultation period to make the statutory proposals more user friendly and less complicated. Duncan Graham said

“the Council’s final recommendations on mathematics and science to the Secretary of State were better than they would have been without consultation.”

(Graham 1993, p.42)

The Science Orders

The Education (National Curriculum) (Attainment Targets and Programmes of Study in Science) Order 1989 was made and laid before parliament March 1989 and it came into force for pupils in Key Stage 3 on 1 August 1989. The Statutory Orders now
consisted of the Programme of Study and seventeen Attainment Targets for Key Stage 3. (see Appendix E for list of attainment targets) grouped into two profile components, Exploration of Science and Knowledge and Understanding of Science.

Table 3.
These profile components were weighted as shown in the table.

<table>
<thead>
<tr>
<th>Science</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Stage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Exploration</td>
<td>50</td>
<td>45</td>
<td>35</td>
<td>30</td>
</tr>
<tr>
<td>of Science</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge and</td>
<td>50</td>
<td>55</td>
<td>65</td>
<td>70</td>
</tr>
<tr>
<td>Understanding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>of Science</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

The Science Working Group had some difficulty in being sufficiently radical in their approach to science in the National Curriculum and mindful of the difficulty of the change process had aimed to secure the confidence of the profession so that it was suggesting an evolution from current good practice rather than an abrupt change. Much of what was proposed at Key Stage 3 was familiar to teachers and featured in the curriculum of many schools. What was different was the structure of the curriculum, with the Programmes of Study and Attainment Targets and the 10 level scale for assessing and whilst teachers did not have much to disagree with in terms of the “what” of the curriculum, many anxieties still remained about how the curriculum would be assessed.

Whilst there was very little disagreement about the breadth of the curriculum at Key Stage 3, consultation seemed to have been focussed on what was in the curriculum, and what had been left out, rather than looking at how the curriculum could be managed, how it would meet pupils needs, and how much time would be needed to teach it effectively.

Despite both the Secretary of State and the Science Working Group explaining clearly that the Programme of Study should be the basis for planning the teaching programme and the Attainment Targets should be used to assess by, the structure and organisation of the Orders gave sharp prominence to the Attainment Targets and the Programme of Study were relegated to pages at the back of the Orders.
With regard to the continuity of the curriculum 5-16 again at the consultation stage there was very little disagreement, but teachers at Key Stage 3 would need to consider carefully how they would cope with building on pupils’ previous science experience, when at least for the next four to five years that experience would be different for each cohort of pupils.

Another change which was given prominence, was the encouragement for stronger emphasis on science education industry links and that pupils should see how science was being used to create new products, and hence new jobs for their parents and themselves.

In terms of assessment, the SWG in the Interim Report had suggested that Standard Assessment Tasks should only be used to moderate school assessments and be applied to a sample of pupils to standardise the group. The Task Group on Assessment and Testing had supported a system that was in the main formative. Teachers were reassured that assessments used would be like teachers’ day to day assessments, they would be directly concerned with what was being taught in order to reveal the quality of each pupil’s performance irrespective of the performance of other pupils. Clearly, here there was a conflict with the Government’s favouring for pencil and paper tasks and league tables.

The SWG also found favour with the teachers in maintaining its insistence that pupils should study science for 20% of curriculum time at Key Stage 4, but they lost this battle with the Secretary of State’s insistence that a second course should be available which pupils could study in 12.5% of curriculum time, leading to a single GCSE.

In essence, the publication of the SWG Report pointed to a clear conflict between the vision of the Government and that supported by the science educators. To sum up the government was looking for a highly prescribed curriculum, detailing what should be taught with increased accountability using tests and league tables - radical change, whilst the Science Working Group and the Task Group on Assessment had re-iterated their commitment to the whole-child, with a child centred approach, building on good practice with formative assessment which stressed the supremacy of teachers’ professional judgement rather than paper and pencil tests.
In the Revision of the Science Orders 1991

Secondary school teachers started implementing the orders for science for pupils in Yr7 - Key Stage 3 in September 1989. A report by HM Inspectorate on the first year 1989-90 found that

"although teaching and learning in Year 7 were less influenced by the National Curriculum than in Year 1, the quality of oral and written work improved and practical work was better matched to a wide range of pupils’ abilities, “

(HMI 1991. p.9)

"and most teachers in years 1 and 7 were familiar with the AT’s and Statements of Attainment. A much smaller number used the Programmes of Study and their work was often good.”

(HMI 1991. p.9)

and with regard to assessment,

“almost all the schools were uncertain about National Curriculum assessment requirements. They often wasted a disproportionate amount of time and energy in assessment matters,”

(HMI 1991. p.9)

and at Key Stage 3

“there were worthwhile attempts to develop curricular liaison with preceding schools, but such initiatives were usually at an early stage of development,”

(HMI 1991. p.16)

and in HMI report on Science Key Stages 1, 2 and 3, a report on the Second Year 1990-91

“Curriculum planning continued to improve. Most schools had revised their courses to ensure that all the National Curriculum ATs were covered. Increasing use was being made of Programmes of Study in planning”

(HMI 1991. p.13)

and

“good science lessons were usually supported by well written schemes. The best schemes resulted from corporate planning, made good use of Programmes
of Study to produce details of pupil activities and included teaching approaches, homework tasks and assessment procedures."

(HMI 1991. p.13)

In these reports there was no hint that there was emerging a need to revise the Orders for Science (and also for Mathematics) but there was the beginnings of rumblings in the educational press about the unwieldy nature of the attainment targets for both science and mathematics. Led by the examining boards, SEAC and some headteachers, the Government was persuaded to seek a reduction in the attainment targets particularly in Key Stage 4. In January 1991 The Secretary of State announced an urgent review of the attainment target structure in Science to be carried out not by the National Curriculum Council but by HMI, and so in May 1991 the National Curriculum Council issued a document containing the formal proposals of the Secretary of State to replace the 1989 Order following a review of the attainment targets because:

- experience had shown that the present structure of 17 targets was proving an obstacle to manageable and sound testing, and intelligible reporting to parents.

- the School Examination and Assessment Council (SEAC) had advised that the consistency and continuity of GCSE standards would be at risk unless the number of attainment targets was reduced. He emphasised that the objective was to simplify the structure, so as to make assessment arrangements more manageable, not to alter the curriculum to be covered.

The reasons given for the review emphasised the government's insistence on testing and it was another indication that the National Curriculum was to be an assessment led-curriculum.

In the consultation document five attainment targets were proposed.

AT1 - Scientific Investigation
AT2 - Life and living processes
AT3 - Earth and Environment
AT4 - Materials and their behaviour
AT5 - Energy and its effects.

The total number of statements of attainment was reduced from 409 to 178.
The new attainment targets then became the NATS. The re-structuring of the old orders was carried out by the identification of essential strands (the term strand was used to describe a sequence of related statements of attainment).

In the National Curriculum Council Consultation Report of September 1991 it was recommended that the five attainment targets in the proposals to the Secretaries of State should be reduced to four:

AT1 - Scientific Investigation
AT2 - Life and living processes
AT3 - Materials and their properties
AT4 - Physical processes

and these should apply to Model A and Model B Science.

It was also suggested that the attainment targets and programmes of study for each Key Stage should be shown side by side and at Key Stage 3 and 4 there should be equal weighting for all four attainment targets ATs 1-4. It recommended there should not be a profile component for science and reporting should be at attainment target and whole subject level. The National Curriculum Council also took the view that there was an unnecessary overlap between material contained in the proposals and material in the Geography Order. Council's view was that statements of attainment which were essentially geographical should be removed from the proposal, whereas statements with both scientific and geographical significance schools should have their scientific aspects strengthened and be retained in the science curriculum.

There was some slight adjustment to the curriculum covered by Model B Science at Key Stage 4 and the Council also recommended that Model A and Model B Science should be re-titled double science and single science respectively. The revised orders were then laid before Parliament in December 1991 and came into force August 1992. The Pilot tests for end of Key Stage Assessment in Science taken in June 1992 were however to be based on the new orders.

Duncan Graham in 'A Lesson For Us All - the making of the National Curriculum' said that

"it became clear that there were very good arguments for revising the attainment targets in mathematics and science to free up the curriculum, reduce the burden on teachers and to make them more compatible with GCSE."

(Graham 1993, p.100)
Graham said that

"Many teachers were against change and they argued that - apart from being a very nasty case of examinations driving the curriculum - that the National Curriculum had hardly got off the ground, and that the changes were going to be made without the slightest evidence of how the mathematics and science curriculum had been working in schools. The changes were likely to confuse and annoy teachers who had already made detailed lesson plans."

(Graham 1993, p.100)

Summary

This chapter looked at the shaping of the Science Curriculum and it shows that the Government was intent on tightening up on the curriculum and making teachers more accountable. This contrasts sharply with the vision of change proposed by both the Science Working Group and the Task Group on Assessment and Testing. The vision expressed by these groups probably had the greatest resonance with science teachers and this had an impact when teachers tried to implement the National Curriculum.

This will be taken up more fully in Chapter 3.
CHAPTER THREE

Changing from what?

Preview

In the view of the SWG and the TGAT, the curriculum planned was not a radical shift but an evolution based on current good practice. The Government was clearly determined that the National Curriculum should raise standards and that by the use of tests and league tables schools and teachers should be more accountable for their work. In order to understand the subsequent implementation of the National Curriculum Science at Key Stage 3 it is necessary to look at what we were changing from! The six case study schools were all in one Local Education Authority (LEA). The LEA had been regarded as very forward thinking in a national context and had introduced a Curriculum Policy Statement in 1984 and a revised version in 1988. The Authority had also introduced tests for pupils at the ages of 7, 11, and 14 during 1985/1986. These tests were largely used to give an indication of standards in English, Mathematics and Science across the authority as a whole. Teachers in years 1-3 of secondary school were required to teach a science curriculum which was based on the Borough Curriculum Policy and during the third year pupils across the Authority took the tests. The testing process caused minimal disruption to school life and had minimal impact on the science teaching. They were regarded by teachers as a “dip-stick” form of assessment. The tests results were used subsequently when pupils took their public examination at 16 to try to identify how effectively schools were operating. This was an early attempt to look at “value-added” issues and also as a way of increasing the accountability of teachers and schools. In respect of science, the Authority was very committed to a broad and balanced science education for all and the LEA had shown its commitment to this policy by appointing an Advisory Team with this specific brief. In support of this Balanced Science Programme, the Authority had instigated a rolling programme of laboratory refurbishment.

The Graded Assessment in Science Project (GASP) was used in several schools and each year more schools were getting involved in the project. During the period prior to the introduction of the National Curriculum several of the case study schools had been involved in re-organisation and had changed their status from 11-14 schools to 11-16 schools. In the three years prior to the introduction of the National Curriculum these schools, in common with all others in the country, were grappling with the demands of the introduction of GCSE. The Authority in which the case study schools were located had a very active Inspectorate, totally separate from the Advisory Service, which spent
the greater part of its time in schools undertaking inspections and monitoring the work of the schools. The Authority also had a Curriculum Advisory Board (CAB) which had been established to advise the Education Committee on matters relating to the curriculum.

Since 1985, the Authority had been committed to developing Primary Science and had a team of advisory staff who were training primary teachers to teach science. There was a considerable expansion and growth in primary science during the three/four years before the introduction of the National Curriculum and issues with regard to continuity and progression with the science curriculum 5-16, had already begun to emerge.

In March 1984, the LEA published a document entitled “A Statement of Policy by the Education Authority on the Curriculum followed in County Schools in the LEA.” This was the product of several subject working groups that had been convened during the previous academic year. In 1985 the Authority established a group known as the Curriculum Development Evaluation Steering Group which met between March 1985 and January 1986 to recommend a structure for the review of the policy statement. This led to the production of a revised edition of the Curriculum Policy Statement in 1988.

Two kinds of groups had been established to keep the curriculum under review.
- a Curriculum Advisory Board and
- Teacher Curriculum Review Groups.

The Curriculum Advisory Board which first met in February 1987 was established to advise the Education Committee on matters relating to the curriculum. Its membership reflected the Committee’s wish to establish a forum for debate, between those who use and those who provide the Education Service, on the curriculum to be followed in schools. In this echoes can be heard of James Callaghan’s view that education had become producer dominated. It comprises members and officers of the Education Committee, teachers, school governors, parents, representatives of employment, and other members of the community. (see figure 4).

Much of the detailed work, however, on the curriculum was carried out by teachers who met in various groups according to age range or subject. There were eighteen groups, fifteen nominated directly from schools and three “phase” groups nominated from the other fifteen. The phase review groups considered cross-curricular matters for the Primary, Secondary and Post-16 age ranges. The recommendations of the groups were reported to the Education Committee through the Curriculum Advisory Board.
In order to get a picture of what schools were building upon when implementing the National Curriculum it is necessary to examine the curriculum policies of the LEA, the role and work of the Curriculum Advisory Board and to draw upon the reports of the Chief Inspector and the Science Inspector during this period.

Most members of the board were nominated by groups of people who from time to time may agree to change their representatives. Figure 5 shows the relationship between the teacher curriculum review groups and the Curriculum Advisory Board.
Initially, post-16 review will be covered by the Post-16 Co-ordinating Panel
An LEA Curriculum Statement

In the introduction to the document the LEA set out the aims for schools as shown below:

a) to help pupils to develop lively, enquiring minds and a love of learning, the ability to question and argue rationally and to apply themselves successfully to task;

b) to develop qualities of spirit, feeling, imagination and a sense of beauty and an appreciation of human achievements and endeavour;

c) to help pupils to acquire knowledge and skills relevant in a fast moving world to their adult lives, at work and leisure and as consumers and citizens;

d) to instil respect for religious and moral values and to help pupils to acquire a reasoned set of attitudes, values and beliefs;

e) to help pupils to understand the world in which they live and the interdependence of individuals, groups and nations;

f) to develop a sense of self-respect and individual worth, a capacity to live as independent self-motivated adults and the ability to work together.

The curriculum is the means whereby these aims are pursued.

The document also states that all maintained schools make available their

- Programmes of Study: details of the coursework followed in key subject areas indicating the attainment targets pupils of different ability and maturity are expected to have acquired at, or near, ages 7, 11, 14 and 16;

- Schemes of Work: how teaching is organised and which teaching approaches are used.

The LEA also hoped that:

- The Governing Bodies of the schools for which it has a greater responsibility in curricular matters will use the Statement as a framework within which they will develop aims reflecting their school’s own identity, individuality and sense of purpose in response to their circumstances, and that

- there will continue to be the greatest agreement between all schools, regardless of their status, about what is taught, for reasons of continuity and coherence for
the individual pupil and the sensible management of the education system to which all schools belong.

The LEA was certainly striving to ensure that there was a local curriculum which would promote continuity and would be coherent.

The LEA stressed in this document that the success of a pupil's learning depends on the effectiveness of the teacher and the school, the involvement of those who depend on and use the education service, in particular parents and employers. The Authority was committed to establishing an effective partnership with all concerned over deciding what is taught in schools and hoped that the statement would contribute to the process.

Within the introductory section, the principles on which the statement is based are outlined as pupils are individuals, that learning how to learn is as important as what is learned, and that education helps pupils to be fulfilled members of society.

On a national level, the debate about education was very focused on an utilitarian view of the purposes of education, within the LEA the fore going show very much a child-centred and whole child approach.

In the curriculum document it addressed the following areas

- pupils as individuals
- curriculum organisation
- learning and teaching approaches
- characteristics of the curriculum
- the secondary curriculum
- assessment and guidance

and salient points from each of these sections are included here so that the reader may get some feel for the culture of the LEA prior to the introduction of the National Curriculum and also to show how much of it was very similar to what would be required when the National Curriculum was implemented.
Pupils as individuals

Within this section the Authority states that all schools are committed to the pursuit of excellence for each pupil, and encourage their pupils, irrespective of their abilities, to realise their full potential and to achieve and value excellence in all worthwhile tasks whatever these may be. It also states that it is the aim of all schools to provide education in and for a society which is multi-cultural and multi-ethnic, emphasising the values of co-operation, communication and tolerance. The policy clearly states that schools have a responsibility to promote equal opportunities for girls and boys.

Curriculum Organisation

In this section the LEA stresses that the curriculum should aim to be broad by making available to all pupils an agreed range of learning and experience. It should be balanced in that it allows adequate development of each area. Each major component of the curriculum should be relevant and should aim at progress in the acquisition of knowledge and understanding. The various curricular areas should reinforce and complement one another so that the knowledge, concepts, skills and attitudes developed in one area may be put to use and provide thought in another, increasing the pupil’s understanding, competence and confidence.

Learning and Teaching approaches

The emphasis here is that teaching should match the abilities, attainments, interests and experience of pupils.

In addition to factual knowledge, it is important to develop concepts, skills and attitudes, and that pupils should learn in a variety of ways according to the task in hand.

Characteristics of the curriculum

The characteristics of the curriculum which had been identified in documents such as Science 5-16: A Statement of Policy

- Breadth
- Balance
- Relevance
- Progression and continuity
- Differentiation
are all discussed, that is the Borough Curriculum document was very much rooted in the national thinking prevalent at the time.

The Secondary Curriculum

The document states that the aim of secondary education is to build on the foundations laid in the primary education programme. The notion of the curriculum 5-16, which had been strongly emphasised in the National Curriculum documents, was not new to schools in this LEA.

Assessment and Guidance

The document states firstly that assessment is integral to learning, and states the purposes of assessment:

"are to help teachers to diagnose pupils’ strengths and weaknesses; to match the work of the classroom to their capabilities; to guide them into appropriate courses and groups, and to report to parents on pupils progress."

(Borough Curriculum Policy 1988, p.17)

The document highlights four main requirements if schools are to fulfil their aims of assessment:

a) clear definitions of expectations as expressed through the aims and objectives of curricula and schemes of work;

b) appropriate methods of assessment as part of normal classroom routine;

c) efficient and effective methods of recording and reporting progress;

d) clear understanding of action to be taken as a result of assessment.

"Assessment involves a variety of techniques, many of them subjective, which the teacher learns with experience to apply to day-to-day observation of how pupils perform across a range of tasks, including discussion and questioning, and to the scrutiny of written work. A range of techniques is used to suit the purpose and the activity."

(LEA Curriculum Document 1988, p.17)
“Although much assessment has to go on in the busy environment of the classroom and must be largely impressionistic, informal assessment needs to be supported by more objective forms of monitoring and testing which should be closely related to the work in hand. Similarly, graded assessments, which have become common in recent years, should reflect the full range of classroom activities. Care must be taken to see that tests do not dominate the work and that they do not so atomise the work that coherence is lost.”

(LEA Curriculum Document 1988, p.18)

“Use needs to be made also of standardised tests which have the advantage of greater objectivity, particularly tests of reading and numeracy, to help to establish a baseline of performance, for screening and evaluative purposes, or for the diagnosis of particular difficulties.”

(Ibid)

The document also contains further statements on recording attainment and achievement, pupil guidance, personal guidance, curricular guidance and careers guidance.

Therefore, the emphasis in the National Curriculum on assessment was very similar to that which had already been established within the LEA.

The Science Curriculum Statement

The Science Curriculum Statement 1988 of the LEA begins by defining the nature of science and then outlines the aims for school science.

Aims

School science should:

a) engage the natural curiosity of pupils concerning the world about them;

b) develop in pupils the modes of thought characteristic of science subjects, for example, critical reasoning and evaluation of data; and sound judgement based on good evidence;

c) enable pupils to develop an increasing mastery of concepts and knowledge which together with a scientific approach, contribute to understanding;
d) enable pupils to develop scientific ways of working (often called the scientific process) so the young adults can bring a scientific approach to the practical, social, economic and political issues of modern life;

e) enable pupils to appreciate how the skills and knowledge of science can be applied to everyday life, recognising social, technological and environmental implications and applications;

f) enable pupils to express scientific ideas, facts and data clearly and appropriately so that they, and others, can interpret, use and discuss them;

g) enable pupils to recognise the importance of team work and co-operation and provide opportunities for them to experience it;

h) foster a range of personal qualities such as open mindedness, healthy scepticism and self-criticism, a sense of responsibility (towards - for example- the environment, their own work and that of their peers), independence of thought and learning and an insight into man’s place in the world.

The statement then outlines the opportunities and experiences provided by science education.

The science curriculum should be broad, balanced and relevant and should draw extensively on the everyday experience of the pupils. It should prepare pupils for adult life and lay foundation for those who will proceed to further education and training in science and be able to make a personal contribution to society’s scientific development. Pupils should experience science as a practical, investigative and problem-solving activity. Pupils will develop understanding and competence in science through active enjoyment in a range of learning experiences.

“Pupils’ early experiences in science should be acknowledged and valued and their subsequent work should reinforce and exploit such experiences. Courses should be designed to give progressively deeper understanding and greater competence over the compulsory period as a whole.”

(Borough Curriculum Policy 1988, p.50)
The statement outlined the scientific method and the skills pupils should develop. The statement also gave details of the science content to be covered by secondary schools and then detailed the objective at age 11 and 16 in skills in the Science Method and in Scientific Knowledge and Understanding. (see Appendix F)

The Borough Curriculum Policy and the Science Policy Statement seemed to resonate remarkably closely with the vision and context for the science in the National Curriculum proposed by the Science Working Group. So, in a sense, teachers within the LEA could possibly feel that because they were working in an Authority which was regarded as being in the forefront of national thinking with regard to educational policy, they had very little to do in order to implement the National Curriculum. It must be remembered, however, that the Borough document is a Statement of Policy - whether the rhetoric and the reality were matched requires an analysis of the Chief Inspector’s Reports and the reports of the Science Inspector.

In January 1986 following Sir Keith Joseph’s speech to the North of England Conference about LEAs role in monitoring and evaluating the curriculum, the role of Inspector within the LEA was radically altered from that of Adviser/Inspector to one totally committed to Inspection. In addition an Adviser for Science and Technology was appointed and for Secondary Science two advisory teachers were appointed to encourage and support schools in developing balanced science course for all pupils. A further Advisory Teacher was appointed to develop the Graded Assessment in Science Project (GASP). In its first year this project involved six secondary schools and a further six joined in the second year. There were 20 schools in the LEA.

The LEA also had two working groups in science under the auspices of the Secondary Science Curriculum Review (SSCR) which were looking at

- Primary/secondary liaison
- Girls and Physical Science.

In addition the Authority had instigated a policy of Laboratory Upgrading and a Capital Expenditure Programme in order to implement the LEA’s policy of balanced science course for all.

So what was the Science Education like in the LEA prior to the implementation of the National Curriculum?
Background and context

It was noted that the work of the advisory service in supporting schools in developing science courses had been severely curtailed because of the need to support 12 untrained science graduates who had been recruited to fill vacancies in January 1987 - a recognition of recruitment difficulties.

In general terms, the science inspector acknowledged that lessons reflected careful planning by teachers who were knowledgeable in their subject specialism. The match between teacher qualification and teaching programmes was satisfactory even in the difficult areas of physical sciences.

A good mix of practical and non-practical activities were observed. Much of the practical activities were designed to illustrate an idea or phenomenon. Practical work that enabled pupils to develop the investigational skills associated with science are much less frequent. The inspector said "there needs to be more opportunities for conducting investigational work unfettered by constant reference to the 'right answer'.”

Despite the encouragement to consider continuity and progression, it is perhaps surprising to learn that all examination courses were seen by schools as being self-contained. Generally, ideas encountered in earlier courses were treated differently or at a greater depth, but occasionally, pupils were offered very similar work to that in previous courses. “There was a need for schools to acknowledge, value and build upon pupils' previous experiences”. At this time an Examination driven curriculum was already well established.

Inspectors noted a decline in the number of entries for Chemistry GCSE and in the number of passes at A-C. It was noted that

“this science suffers most from the competition of other expanding curriculum areas. In order to preserve the subject and to complete the science education for all sixteen year old children, it is essential to continue the development of balanced science courses within 20% curriculum time.”

(CEI Annual Report 1987)
Amongst priorities for the future the inspector highlighted the following.

- The need for departments to update their schemes of work so that they clearly describe what pupils will know, understand and be able to do for each course, suggest suitable pupil activities to achieve these learning objectives and indicate the links between them and the pupil assessment scheme;

- Departments should consider the purposes to which they put practical work;

- Teachers should adopt a wider range of teaching methods which emphasise pupils’ understanding of scientific concepts rather than being concerned with the accumulation of facts and also those which develop in pupils the skills to enable them to become confident independent learners.

**Annual Report 1987 - 88**

During this academic year the Inspections focussed on the ways schools have developed courses and assessment methods relevant to the GCSE. This included the appropriateness of teaching methods and the effectiveness of providing for pupils of different abilities. The match between the Authority’s science curriculum policy and that offered by the schools was also inspected.

**Main findings**

All schools required pupils to study a Science to the age of 16. In half of the schools inspected this comprised balanced science courses. Most of the other schools inspected planned to introduce balanced science courses for all fourth year pupils in September 1988.

The curriculum in all schools was supported by teaching schemes which were usually very detailed for the first three years. In examination classes, the examination syllabus was the main document for planning lessons. Good teaching schemes for all courses described intended learning in terms of what pupils should know, understand and be able to do following lessons. The best lessons were based on good teaching schemes. Teachers generally had a good understanding of the demands of the courses including the new ones that led to GCSE accreditation.

- Generally, teachers kept satisfactory records of work done with pupils and of assessment of pupils progress. Sometimes these records are put to only limited
use and more can be done to apply this information to a systematic evaluation of
course and teaching methods.

- In most schools, some progress has been made in securing curriculum continuity
  but some activities that were part of pupils' earlier experiences are needlessly
  repeated in examination courses. Pupils' concept development was progressive
  where their previous achievements were acknowledged. Continuity between the
  primary and secondary phase is still problematic.

- Practical activity is still more frequently used to illustrate a scientific fact or
  phenomenon than to address such process of science as hypothesis making and
  testing.

- Teachers continued to increase the emphasis on understanding rather than
  memorising facts. They were developing more strategies to this effect and were
  less dependent on teacher talk. Pupils were still too often all set the same task
  rather than work appropriate to their individual needs and achievements.

Overall, the standard of science teaching was improving and pupils' experiences were
equipping them to take a more scientific view of issues and problems they encountered.

The Graded Assessment in Science Project (GASP) was operational in six schools and
a further six planned to start in the year 1988-89. The Inspector noted that many
aspects of this assessment scheme share the same characteristics of the proposed
national programme. Many secondary teachers will therefore be well prepared for this
development when it occurs in the period 1989-90.

Priorities for the future

As a result of inspections, schools have been asked to pay particular attention to:

1) planning the experience pupils have and work set them in terms of the intended
   learning;

2) arrangements for meeting the needs of pupils of different abilities through
   grouping, choice of course material and the setting of tasks that both challenge
   and allow success;
3) the purpose of practical work so that opportunities are taken to enable pupils to develop and practise the skills of scientific methods;

4) evaluating the work of science departments through an analysis of the learning achieved against the statements of intended learning;

5) formal planning for development and the management of change.

Summary

Teachers within the LEA were well provided for in terms of curricular guidance and with the introduction of Balanced Science courses and the Graded Assessment in Science Project, could be considered to have been well placed to introduce the National Curriculum. There was a surprising close match with the Borough Policy Statement for Science and the content of the National Curriculum and even the term Programmes of Study had already been used in the LEA document. What was different, was the structure of the National Curriculum and from the inspection findings, whilst progress was being made, there was concern about several aspects of teaching, learning and assessment which may be an impediment to introducing the National Curriculum and realising fully the vision for the curriculum.

Particular concerns would be the very infrequent use of investigative work, because the structure of attainment target 1 in science demands that pupils are involved in investigative work rather than the illustrative practical activity which seemed to be dominating much of the lessons.

It is difficult to see how schools which were not building on pupils earlier science experience in the early years in their own schools would take up the challenge of building on the work pupils had done in primary schools. The Inspection process also highlighted at this time the need for departments to structure their Schemes of Work so that they describe what pupils will know, understand and be able to do, and to suggest suitable pupil activities to achieve the learning objectives and to link closely the learning and the assessment process. The structure and use of Schemes of Work was a particular focus of the research. The Inspector had also expressed concerns about the limited range of teaching methods with emphasis on the accommodation of facts rather than the development of pupils’ understanding of scientific concepts and the skills which would enable them to become confident learners.
Immediately prior to the introduction of the National Curriculum several of the schools were coping with major change in switching from separate Science courses to Balanced Science courses and also in becoming more familiar with the demands of the GCSE course. Again, during this period concerns were aired about the limited use of assessment information and once more the issue of continuity between primary and secondary education was highlighted. Practical work was still largely illustrative and the processes of hypothesis making and testing had very little emphasis. This would cause considerable problems as schools tried to implement the National Curriculum.

Teachers were making changes to their teaching styles and were increasing the emphasis on understanding rather than memorising facts. Despite signs of improvement, there was still considerable concern about the match between provision and the individual needs and achievements which would have implications for how successfully schools would introduce the National Curriculum. In the two years prior to the introduction of the National Curriculum, six of the the twenty schools in the LEA were operating the Graded Assessment in Science Project (GASP) and a further six introduced it in the year immediately prior to the National Curriculum, probably encouraged by the inspector’s comment that it shared many of the characteristics of the proposed national programme. The Borough Curriculum Policy for Science, both in terms of the content and processes, had much in common with what was set down in the National Curriculum Science. This was particularly true for the curriculum in science in secondary schools in years 1-3 (to be come Y7-9) and the National Curriculum for Key Stage 3.

Schools within the LEA probably felt that the comments of both TGAT and SWG about the National Curriculum being an evolution of good practice meant that they were in a relatively good position to start to implement the National Curriculum. It is interesting to note however, that despite the rhetoric of the Curriculum Documents and the work of the schools in implementing things like GASP, there was at this time within the LEA, as the inspection findings show, quite a gap between the rhetoric and the reality. This emphasises to me that schools are not developed by simply stating what they should do. Curriculum development goes hand in hand with teacher development.
CHAPTER FOUR

Vision of Changes

Preview

This chapter looks at how teachers were informed about the nature of the changes involved in the National Curriculum and something about what was expected of them. The communication of what was required occurred in several ways:

- use of the two additional training days - known as Graham Days;
- In-service Training
- a range of documents from both SEAC and NCC which arrived at intervals during the first run through of KS3 1989 - 1992.

When the Statutory Orders for Science finally reached schools, teachers had been through several drafts of orders and subsequent consultation and refinement periods. The final product could be regarded as being a compromise between at least four visions of the curriculum.

Visions

- the vision of the Science Working Group.
- the vision of TGAT, particularly with regard to how the curriculum may be assessed.
- the vision of the science education community about what a National Curriculum in Science ought to look like.
- the vision of the Secretary of State for a curriculum that would raise standards and ensure the accountability of teachers and others in schools.

Initially, at least there did seem to be some congruence between the vision of Kenneth Baker and the Science Working Group as this quote from a letter published in the Interim Report to the Science Working Group from the Secretary of State

"There must be space to accommodate the enterprise of teachers, offering them
sufficient flexibility in the choice of content to adapt what they teach to the needs of the individual pupil.”

He did stress to the Working Group the need for specificity in the definition of attainment targets and in paragraph 10 he reassured teachers

“that much of the assessment will be school based. It will be done by all teachers as an integral part of normal classroom work, but, in addition there will be nationally prescribed tests done by all pupils to supplement the individual teacher’s assessments”.

(Letter from Secretary of State - SWG Interim Report 1987, Annex B. Para 4)

The vision that the Science Working Group had was that they were

“working towards a consensus of views on science in the National Curriculum”

(Letter from Secretary of State - SWG Interim Report 1987, Annex B. Para 10)

and that they were aiming to

“produce a framework that is simple, clear and coherent whilst allowing scope for the enterprise of teachers and schools”.

(Interim Report SWG 1987, p.6)

So at the Interim Report stage of development there did seem to be a considerable degree of agreement in the vision of the curriculum of the Science Working Group and that of the Secretary of State.

Similarly, the Task Group on Assessment and Testing (TGAT), which had been set up by the Secretary of State with the purpose of making recommendations about how children’s performance and progress across the subjects of the National Curriculum should be assessed and be reported to those with a right to know, had also made very reassuring noises and had recognised some of the fears about National Assessment:

“TGAT knows that many teachers are apprehensive about some possible outcomes of a national system of assessment”.

(TGAT 1987, Para 13)
There are worries that

- some pupils may be disadvantaged.
- relations between teachers, pupils and parents may be soured.
- that schools or teachers may be singled out unfairly.
- that the process may unduly constrain the work of a school.

In arriving at its recommendations, the Group has aimed to prevent or minimise those possible consequences, and also very reassuringly the recommendations of the Task Group are designed to make full use of the existing expertise and good practice that already exists in many schools.

TGAT recommended

- Assessment policy should follow from decisions about the curriculum.
- Assessment methods are important in that they clarify curricular aims and provide the essential information about success in achieving these aims.
- They must together provide a clear language to communicate aims to pupils, to their parents and teachers and to the wider community.

(TGAT 1988, p.6)

The system of assessment proposed is in the main formative, in that its purpose is to provide information that will be of help when deciding how pupils' learning may be taken forward, both individually and collectively.

- The assessments proposed by the Task Group are like teachers' day to day assessments, they are directly concerned with what is being taught and they are designed to reveal the quality of each pupil's performance irrespective of the performance of other pupils.

They rely on clear descriptions of the performance being sought.

The Task Group proposed that the reporting system should use a scale of 1 to 10 to
cover the full range of progress that children of different abilities make between the ages of 5 and 16.

- Each number is to represent a level of achievement. A level should be specified that it will represent the average educational progress of children over about two years.

Teachers, generally and particularly within the case study schools were reassured by the various factors and the case study schools may well have thought they had little to do as they were working in an Authority which was at the forefront of national developments and also had been very involved in the Graded Assessment in Science Project (GASP).

In my experience all schools labour under the misapprehension that they are beacons of good practice. However, by the time the Final Orders for Science hit the statute books, the visions for the curriculum of all the various factions had begun to look very different. This chapter looks at how, in the months leading up to the implementation of the National Curriculum for Science and during the first run through, the vision of the curriculum was communicated to teachers.

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**Preliminary In-service training**

The LEA in which the case studies are situated used the two additional training days (Graham Days) for whole borough training and all teachers from each subject area met together to look at the structure of the Orders and to become familiar with some of the terminology associated with the National Curriculum. At this training particular emphasis was placed on Attainment Target 1 and Attainment Target 17 and the aspects of Barth and Space which were new to most science teachers. All heads of departments in the LEA took part in a two day residential conference where amongst other things they had presentations from the National Curriculum Council Professional Officer Mike Coles about the National Curriculum Science and there was also an opportunity to look at materials being prepared by publishers to support the implementation of the National Curriculum. In addition, Heads of Departments spent some time in the portable Sky-lab which could be hired by schools to be used as a mobile planetarium to provide learning opportunities for pupils in Astronomy. At this stage there was no input on managing change or any aspect of managing the curriculum. The teachers' perceptions of the effectiveness of INSET for the National Curriculum formed a part of the research and is discussed in Chapter Six.
In-Service Training for the Introduction of the National Curriculum:
a report by HM Inspectorate 1988-1990. HMI reported that

“Training on the scale required for the introduction of the core subjects of
the National Curriculum had not been attempted before. LEAs responded well
to the challenge but advisory teachers were fully stretched to provide the
considerable volume of training required”

(DES 1991, p.9)

and also

“The strengths of the National Curriculum training between 1988 and 1990
were the good quality of the majority of training sessions visited and the
willingness of school teachers to participate. More than four-fifths of the
sessions were satisfactory or better”

(Ibid)

It was also noted that

“by the end of the report period (1990) the majority of teachers were better
informed and more confident about implementing the core subjects of the
National Curriculum. However, anxieties about assessment, recording
and reporting were largely undiminished. The teachers’ training needs changed
once they had started to implement the National Curriculum by becoming more
specifically related to the difficulties they were encountering.”

(DES 1991, p.9)

HMI also observed that

“A particular difficulty, even for skilled trainers, was the wide range in
individual teachers’ knowledge and understanding of the core subjects and
assessment”

(DES 1991, p.10)

HMI also said “too little attention was given to training key people to be trainers of
others”

(DES 1991, p.10)
In conclusion HMI noted that

"Overall schools were faced with a difficult task. There was much to be done in a short time. This led to some uncertainty and anxiety. Hard work and professionalism by the providers and teachers meant that, despite some difficulties in organising the provision, the training received by most teachers was satisfactory or better"

(DES 1991, p.10)

In terms of awareness raising sessions HMI commented

"Awareness raising often took the form of day conferences...the main thrust of the conferences was to provide useful and necessary information about the Education Reform Act and the National Curriculum in particular, with reference to Programmes of Study, cross-phase liaison, school development plans, and sometimes, aspects of assessment and recording. In most cases this was a useful way of helping teachers to make sense of a mass of documentation and the unfamiliar language of the National Curriculum that many regarded at this time as impenetrable. Occasionally there was an over-emphasis on employing reassuring platitudes to boost confidence, and teachers found this irritating. Skillful speakers concentrated on general principles and familiarisation and kept away from the detailed proposals emerging from the subject working groups, but not, at that time, enshrined in statutory orders. Their training was most effective when they both discussed implementation and acknowledged that the task presented a considerable challenge”

(DES 1991, p.14)

HMI said that

"the training was not satisfactory when the awareness raising conferences became ‘set piece’ presentations regardless of the needs of the schools represented and the even greater variation in the needs of the individual teacher. This was in part a consequence of LEAs having to make provision for large numbers of teachers and of spreading the training over several months.”

(Ibid)

It was against this backdrop of awareness raising and familiarisation training that secondary science teachers started to think about the implementation of the National Curriculum which heralded the end of a sustained phase of curriculum development which had largely been initiated as a result of pressure for change coming from the
science teachers themselves and where most schools had felt that they had enjoyed considerable professional autonomy in deciding what should be taught in the first three years of secondary school, whilst recognising the influence of the Examination requirements in the upper school. The real change for science teachers therefore was, moving from free-choice to a tightly structured curriculum, although what had been prescribed was not markedly different from the curriculum that had previously been covered in years 1-3 of secondary schools although in greater breadth. This change in culture was also accompanied by the sceptre of accountability associated with the new, but at this stage, largely unknown, assessment procedures. Was it here that the first seeds of the dependency culture were sown?

Preparing for the implementation of the Statutory Orders.

Just after the Easter holidays in 1989 Science teachers received the Statutory Orders for Science in the National Curriculum. They arrived in rather imposing ring binders which had the design feature of an identified national curriculum colour and the irritation of being hole punched in four places. In many cases the Orders were eagerly anticipated in advance, but like most of the documents that followed, once they were generally available they tended to gather dust. For the first time science teachers had a framework which they were legally bound to teach. The introductory pages which were called the Statutory Instruments were written in a legal jargonese which was not only off-putting but also had an intimidatory effect, for example,

"The provision of the Order relating to the third key stage shall come into force on 1st August 1989 in respect of pupils in the first year of that key stage who do not have a statement of special educational needs;
on 1st August 1991 in respect of pupils in the first year of that key stage who have a statement of special educational needs and in respect of pupils in the second year of that key stage, and
on 1st August 1991 in respect of all other pupils.

Schedule 1 Article 7 Specification of Attainment Targets outlined that for
KS 3 Attainment Targets 1-17; levels 3-7 where specified in the Document.
and Schedule 2 Article 8
Specification of Programme of Study
Key Stage 3 As set out in the document."
Vision of Science Working Group and of the Secretary of State.

The introductory section was then followed by Attainment Targets and associated statements of attainment: Key stages 1-3. This section covered 62 pages and specified each of the Attainment Targets and the associated Statements of Attainment. At the back of this section the The Programmes of Study for Key stages 1-3 could be found. The Programme of Study for Key Stage 3 covered three pages and included a general introduction on Communication and on the Application of Science. Exploration of Science included what was termed detailed provisions and this was followed by Knowledge and Understanding of Science; Detailed provision-sixteen paragraphs. These paragraphs corresponded with Attainment Targets 2-17 although they were not numbered and this was not made explicit anywhere in the document.

Having seen the Orders, Science Departments planned to implement the new curriculum in September 1989. Science Departments in the Summer term of 1989 had to make plans to implement the National Curriculum for pupils arriving in the first year (now renamed Y7) from September. In acknowledgement of the tasks all schools were given two extra training days (known as Graham days) one in the Summer term and one in the Autumn term, although in the case study schools, these were used for borough wide training. Whilst science teachers were probably familiar with the knowledge and understanding in the attainment targets, they were not familiar with the structure and organisation of the document. In addition there was a whole, new vocabulary to come to terms with, Orders, Attainment Targets, Statements of Attainment, Programmes of Study, Key Stages etc. The ten-point scale and its definition of progression within an attainment target was also the subject of controversy and disagreement.

Science teachers however had been reassured by the Science Working Group that although the Orders were breaking new ground there really was nothing very innovative and they were largely based on current good practice.

So the question for Science departments was do we need to do anything special to implement the National Curriculum? In other words is our department already doing these things or not?

Do not all science departments consider themselves to be models of good practice? Could this account for some of the subsequent tensions between change and continuity? At this point science teachers could be forgiven if they were confused, would the implementation of the National Curriculum present an enormous challenge or was it a question of keeping up and building on their current good practice?
What help was available?

Support for implementing the National Curriculum

In implementing the Science Orders, teachers were faced from the outset with the tensions between prescription and freedom and between enormous challenge and change and building on current good practice.

Mid-way during the Summer term, schools received help in the form of the Non-Statutory Guidance (NSG). This material was produced by the National Curriculum Council and written and edited by teachers and others concerned with science education to provide a reference for teachers in planning and implementing the National Curriculum. The introductory section explained that the Non-Statutory Guidance philosophy addressed the important principles and issues which helped to shape the Science Order of the National Curriculum.

The Non-Statutory Guidance was intended to be used by teachers both at In-service Training and within their own school as they worked together to produce Schemes of Work for Key Stage 3.

The Non-Statutory Guidance discussed the following areas:

- science, English and mathematics;
- what it means to be scientific;
- the contribution of science to the curriculum;
- learning science;
- teaching science.

In the introduction to science in the National Curriculum teachers were once more reminded that

"the process of developing a National Curriculum for science has been one of consultation in order to arrive at a consensus about what constitutes good science education. This has evolved from surveys and curriculum development activities that have ranged from individual teachers’ projects and school initiatives through to LEA and national schemes. The statutory Order for

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science represents a current definition of science education. The continued improvement in the quality of science education requires that the programmes of study and attainment targets should be:

- interpreted by teachers in the way they consider most effective;
- extended where necessary to bring about relevance and coherence in science courses;
- supported by curriculum development activities at all levels;
- reviewed and refined in the light of experience, technological advance and curriculum development.

(NGS Science 1989, p.A1)

Teachers were also told that the Non-Statutory Guidance did not aim to address all the issues that schools need to consider in implementing National Curriculum science. The early sections of the guidance tended to address issues which were probably very familiar to science teachers and the most helpful section was that on teaching science. It was in this section that teachers were reassured about maintaining their traditional freedom of interpretation.

"The National Curriculum for science forms the framework on which teachers can base the application of their professional skills to deliver an effective science education programme which meets the needs of their pupils. The ways in which teachers use their traditional freedom of interpretation will determine the overall quality of the science education offered to pupils."

(NGS Science 1989, p.A1)

Teachers were also told that

"The structure of the National Curriculum and its assessment provides a clear and firm basis for teachers to plan their teaching."

(NGS Science 1989, p.A8)

This section included, what with hindsight can be seen as the understated advice that the Programmes of Study provided the main planning tool, but the statements of attainment will also help teachers to judge the appropriate level of challenge for individuals or groups within the class.
The teaching science section also reminded teachers that

"providing appropriate learning experiences for the full ability range of pupils is a difficult task. It requires careful planning and sensitive teaching by teachers with a broad understanding of science and the ability to match the work to their pupils’ capabilities."

(NSG Science 1989, p.A9)

It goes on to say that “activities must challenge all pupils and, at the same time, provide them all with success at some meaningful level”. The common framework with 10 levels within an attainment target provides a helpful way of considering progression and allows the teacher scope to provide work appropriate to pupils differing needs according to their understanding and competence. The Non-Statutory Guidance suggests that “some schools may consider organising classes according to ability” but reminds teachers that “whilst this helps with the matching of demand to the potential of the pupil, it must be borne in mind that not all attainment targets in science will offer the pupils the same scale of difficulty at a particular level”. The Non-Statutory Guidance draws attention to Scl Exploration of science as a special case of this and highlights that

“Achievement in the strategies and skills of science is related to the concepts involved in the investigation, but the complexity of any given investigation is an independent factor in which some pupils succeed better than others”.

(NSG Science 1989, p.A9)

The Non-Statutory Guidance reiterates and stresses that

“teacher’s assessment of pupils’ current achievement and judgement about their potential is very important and should be considered in all plans for activities, and in the organisation of class structure”.

(Ibid)

In addition to providing the above advice the Non-Statutory Guidance also provides a very useful checklist to assist teachers in selecting particular learning experiences for their pupils.
Selecting learning experiences for pupils

Teachers and schools have the responsibility to design their own teaching schemes within the overall framework of the programmes of study and the attainment targets. Teachers may find the following criteria useful in selecting particular learning experiences for their pupils. It may also be used as a checklist for evaluation. Will the experience give pupils the opportunity to:

• develop scientific strategies and skills;
• develop attitudes appropriate to working scientifically;
• develop basic scientific concepts;
• reach a satisfactory outcome;
• apply scientific ideas to real-life problems, including those which require a design and technological solution;
• work co-operatively and communicate scientific ideas to others;
• develop an understanding of the relationship of scientific ideas to spiritual, ethical and moral dilemmas;
• discuss the ways in which scientists work?

Will the experience:

• stimulate curiosity;
• relate to the interests and everyday experiences of the pupils;
• appeal to both boys and girls and those of all cultural backgrounds;
• help pupils to understand the world about them through their own mental and physical interaction with it;
• involve the use of simple and safe equipment and materials;
• involve resources and strategies available to teachers;
• contribute to a broad and balanced science curriculum, bearing in mind experience already selected?

(Science Non-Statutory Guidance P.A. 11 (1989))

It would be possible to reply positively to all these statements but not cover or meet the requirements of the Science Orders OR the subsequent Assessment Orders and this shows clearly the authors of the Non-Statutory Guidance were trying to influence “how” the curriculum was to be delivered rather than saying “what” was to be taught and leaving it to teachers to decide the “how”.
Planning for Learning - constructing a scheme of work

Section B of the 1989 Non-Statutory Guidance provided a mechanism that schools could use to produce a scheme of work that covers the requirements as set out in the Statutory Orders. The guidance declared that programmes of study should form the basis for developing a scheme of work and explained that paragraphs of the programme of study corresponded with particular attainment targets. The statements of attainment could help teachers to sharpen the focus of the scheme of work and to ensure that pupils have the opportunity to attain at a particular level. The Non-Statutory Guidance in section B - part 2 stresses that

"in order to provide a coherent structure for the science curriculum in a school, it is essential that teachers have a shared vision of the purposes of their teaching" and further that "the development of the scheme of work, by teachers working together, is a mechanism whereby a co-ordinated approach can be achieved."

(NSG 1989 section B part 2, p.B1)

What is a scheme of work?

The Non Statutory Guidance defines a scheme of work as a written statement which describes the work planned for pupils within a class or group over a specific period of time and is an essential part of the school's documentation and it should reflect the school's agreed approach to teaching and learning. It should be written so that all teachers within the school can use it as a practical guide to teaching with the school's curricular programme. The schemes of work according to the NSG should be a working document which will be frequently reviewed and amended to take into account more effective teaching methods.
Schemes of work and the teacher's accountability

There was also a clear message about teachers accountability

"The programmes of study and attainment targets can be viewed as a checklist. The scheme of work must ensure that all items on the checklist are experienced, sometimes more than once within a key stage... The place of science in the curriculum takes many forms, ranging from subject-based organisation to being part of an integrated curriculum. Whatever kind of organisation is adopted, it must be possible to account for science provision in terms of the National Curriculum. A scheme of work is an essential part of this accountability."


Science departments were encouraged to tackle the revision of schemes of work in a gradual and cyclical way so that there would be sufficient time available to enable everyone who will be involved in the teaching to contribute to the planning.

Thus, the way in which departments should go about implementing the National Curriculum had been spelt out and to some extent the production of the science Order and the accompanying Non-Statutory Guidance could be interpreted as the first step in moving science teachers from an entrepreneurial, albeit autonomous, in producer-dominated culture to a more accountable, consumer dominated, culture which carried with it the the beginnings of a dependency culture.

Guidance on Assessment

The issue of assessment was probably the greatest concern of science teachers and to date they had received considerable reassurance about the methods of assessment to be adopted. At this stage the guidance and advice was coming from the professionals who understood both the teachers concerns and the needs of the pupils. The assessment of the National Curriculum was very much in the forefront of a political drive spearheaded by the Government and underpinned by the Parents' Charter. Teachers started to implement the Science Orders without any clear idea about what form assessment would take, both during the Key Stage and also for the end of Key Stage Tasks, other than what had been said by TGAT. At the implementation stage the only advice on assessment was to be found within the Non-Statutory Guidance where teachers were told that further guidance on aspects of assessment would be provided by the School Examinations and Assessment Council (SEAC) but the scheme of work would need to address the following
strategies which will be used for assessment;

how assessments might be related to levels of achievement;

tasks or questions which have proved to be formative indicators (to both teacher and pupil) that aims have been met and levels of attainment achieved;

what records and evidence should be kept for moderation, both internal and external;

arrangements for the sharing of judgements about pupils' performance between teachers;

how to act on the information that has been collected.

(NSG Science 1989, p.B3)

Advice and guidance on assessment prior to and during the early stages of implementation had come from two principal sources, Task Group on Assessment and Testing (TGAT), and the Science Working Group as discussed in Chapter 2.

TGAT in the first of three supplementary reports

"Re-affirms that to meet National Curriculum objectives a balance is required between standardisation tests (both written and otherwise) and other forms of assessment, and that the use of externally prescribed tests and of teachers' own assessments combined through effective moderation procedure, offers the best means of securing standards, enhancing professional skills and improving learning. It concludes that no alternative or simplified system could guarantee these or achieve the general criteria stipulated in its main report and remit.”

(TGAT 1988, p.1)

In the introduction to the three reports TGAT states

"The message we do wish to stress is that the systematic scheme of assessment we advocate can bring valuable benefits to teaching and learning alike.”

(TGAT 1988, p.14)

In 1988 the Science Working Group defined

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“the purpose of assessment is to show what a pupil has learned and mastered, so as to inform decisions about the next steps and to enable teachers and parents to ensure that he or she is making adequate progress. Assessment should be seen as part of the teaching process and made in such a way as to give valid information.”

(SWG 1988, p.84)

In involving pupils the Science Working Group in their final report in 1988 state

“Pupils should also have opportunities to understand the assessment process themselves. Knowing the criteria, and taking responsibility for making their own judgements, will deepen their understanding of the learning activity.”

(SWG 1988, p.87)

In their interim report 1987 the group had recognised

“the importance of assessment in monitoring and communicating pupil performance and progress against the attainment targets we have identified.”

(SWG 1988, p.70)

They also acknowledged

“the central importance that assessment can have in promoting a range of desirable learning experiences, diagnosing strengths and weaknesses, and raising expectations and overall attainment.”

(SWG 1988, p.70)

They stressed their belief

“that assessment can have a constructive and positive role in teaching and learning but that, when narrowly conceived, applied and interpreted, the reverse is often the case.”

(SWG 1988, p.70)

The working group also said that
“because of the relationship between assessment and learning, teachers will need to be involved centrally in the process and should regard it as part of their professional work in appraising pupil progress.”

(SWG 1988, p.71)

The group reminds us that assessment can be an effective tool of diagnosing learning difficulties, describing performance and pointing the way to improvements, but warns “it can also represent a heavy commitment for teachers.” The Working Group stated the need for the timing of assessment to fit in with the teaching programme.

“Since it is an integral and continuous part of the learning process for all primary and secondary pupils’, an assessment procedure implemented every three years is unlikely to be an effective method of diagnosing learning difficulties.”

(SWG 1988, p.71)

The SWG and TGAT though their reports were very determined that the curriculum should not be dominated by the spectre of accountability nor that it should become assessment led. In the guidance of both groups, the approach to assessment was constantly stressing the formative purposes. To some extent this may account for the confusion both in teachers’ minds and also in the complexity of the arrangements announced for the end of the Key Stage. If from the outset teachers had been clear about what exactly would be required of them by the end of the Key Stage, then they could have decided how best to approach both the formative and summative aspects of assessment.

November 1991 - Detailed guidance arrives

The first cohort of pupils following the National Curriculum Science had been studying it for more than 6 terms and were less than two terms away from the end of key stage 3 tests when the first detailed guidance on assessment from SEAC arrived in schools in Nov 1991 Teacher Assessment at Key Stage 3: an in-service resource science and the leaflet Teacher Assessment at Key Stage 3 (published Sept 1991) notes that Teacher Assessment should play a key point in recognising pupils attainments and making sure they are used to shape future learning. It should be continuous through the Key Stage. The purpose of the leaflet was to assist schools to review their current practice in teacher assessment. The leaflet focussed on:


- professional judgement;
- involving pupils;
- recording attainment;
- collecting evidence;
- reporting to parents.

SEAC, as the Working Group, SWG, TGAT, and HMI had done, reiterated that assessment is a part of everyday teaching and learning and that it should not be seen as a separate activity necessarily requiring the use of extra tasks or tests.

On the matter of professional judgement it states that

"Teachers must make their own judgements about their pupils' achievements in relation to attainment targets and statements of attainment."

(SEAC 1992)

and emphasised that

"discussion with other teachers about how and why judgements have been made are important in trying to achieve more consistent interpretations of statements of attainment."

(SEAC 1992)

The leaflet also outlines how involving pupils in assessment "can help pupils to understand what they are learning and to chart their own progress."

The advice given with regard to recording attainment says that the question of how to record is a matter of professional judgement best decided within schools, but cautions that recording should not be unwieldy or time consuming or get in the way of teaching and learning. It also reminds teachers about collecting evidence so that they are "able to point to examples of achievement which support particular judgements."

The notion of collecting evidence was clearly an issue as the research will show. Why is it necessary to collect evidence? What is professional judgement? How much evidence? Who is the evidence for? These are the questions teachers were asking!

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The leaflet concludes with a brief section on reporting to parents and advises that parents will need help to become familiar with the National Curriculum framework so that they can more easily understand how their children are progressing.

**Teacher Assessment in Practice  SEAC 1991**

This booklet was sent directly to schools without any supporting training being provided. The guidance, which many teachers regarded as potentially the most useful, did not arrive in schools until the first cohort had almost reached the end of Key Stage 3. SEAC in this booklet discussed strategies teachers would need to use to ensure that teacher assessment supports and does not inhibit teaching and learning. These strategies involved the teacher in planning opportunities to mark, observe, listen and discuss work with pupils. The planning will help teachers focus on the purposes of activities by picking out aspects of the programme of study and attainment targets that will be covered. Teachers were also encouraged to include in their planning a wide range of different assessment techniques in order to help all pupils show what they know, understand and can do.

The booklet used accounts from practising teachers showing how teachers built in assessment opportunities into their planning and teaching. The accounts addressed how a planning form could be used to build in opportunities to assess and how a teacher managed the lesson to allow opportunity to assess and record during the lesson. The teacher chose to focus on a small number of statements of attainment likely to be addressed during a normal classroom activity. The teacher organised the class into working groups enabling the teacher to work with both individuals and groups. The teachers used a prepared checklist which was structured around the chosen statements of attainment but also allowed for comment on unexpected outcomes.

Marking was done against criteria rather than using grades or marks out of ten so that pupils knew more about how they were doing. The booklet also suggested strategies for coping with ephemeral evidence, such as the evidence displayed by pupils when they are discussing work with each other or with their teacher or when they are working practically or conducting an investigation. In the section on helping pupils to show evidence of their attainment teachers are reminded that pupils can often show a more thorough understanding of a subject than would be revealed in written work and the use of questioning on the part of the teacher may encourage pupils to show they know more about the subject. It was suggested that the teacher can provide permanent evidence of the pupil’s attainment by recording the results of the discussion on the
pupil's work. In this section it is suggested that pupils with learning difficulties may find the gap between statements at different levels too large to make viable progress so it may be necessary for the teacher to set additional learning targets so the pupils have more frequent successes.

The guidance was clearly all good practice. Teachers were asking "But is it what will be statutory required?" was SEAC worried about the way the National Curriculum was being taught? was it their business to worry?

In discussing marking policy the guidance says

"pupils may feel uncomfortable with a sudden change in the way work is marked. If they are accustomed to getting marks out of ten or a grade on their work they may find it difficult at first to adapt to marking which offers detailed comments on the quality of their work or which asks them questions and expects answers. Involving pupils in reviewing their work and setting future targets can help this transition."

(SEAC 1991, p.14)

It also stresses the importance of feedback to pupils, including recording questions and discussions as they happen can help considerably when attainments are not obvious from written work alone.

The guidance also talks of the importance of having an agreed marking policy so that pupils, teachers and parents know what to expect. This is obviously a whole school issue and at this time with the staged implementation of the National Curriculum and the demands of LMS etc; many school managers were unaware of the need to discuss and formulate a policy.

In the section on involving pupils in their own assessments the guidance makes clear that

"the statutory statements of attainment must be used for assessment by teachers ... although pupils can be actively involved in recording their own attainments, the teacher should be responsible for the accuracy of such a record."

(SEAC 1991, p.17)

In addition to involving pupils in their own assessments, guidance is given about involving pupils in collecting evidence of their attainment. It suggested that record cards
could be used with spaces for comment by pupil, teacher and parent and the system should mean that pupils are given clear and simple targets which they can understand in terms of their own learning and it also encourages pupils to note down any evidence they think is relevant from other subjects or outside school. The guidance adds a note of caution that “recording could become mechanistic or boring for pupils, especially if they are doing something similar in other subjects. It also suggests that

“pupils may need a great deal of initial help in understanding why they are being asked to record and judge their own work and how they should do it.”

(SEAC 1991, p.20)

and I suspect that many teachers were asking why they needed so much paperwork and evidence to support their judgements.

In addition to the fore-going advice an example is included of a termly pupil - review sheet which would link together their term’s activities, the pupil’s achievements and areas for improvement. Again, a note of caution appears in the guidance - it is suggested that pupils are involved in a lot of written evaluation and that there may be pupils who are less competent and skilled in writing who would benefit from being helped to talk about their work first.

In the guidance about recording attainment and collecting evidence it warns that it is neither possible nor desirable to collect evidence relating to everything an individual does. It is only necessary to record or collect evidence of those aspects of pupils’ achievements which show some significant attainment or progress. The guidance also notes that previous experience of GCSE is valuable and relevant to implementing teacher assessment Key Stage 3.

There was continued confusion between the “how” and the “what” of the curriculum and its assessment which arose because as yet no one had clarified exactly what was to be expected with regard to end of Key Stage 3 assessment.

In many respects this guidance most clearly exemplifies why teachers were starting to make noises about the paperwork demands of the National Curriculum - is this really the way to raise standards?

From this mass of guidance teachers could distil the following

- The need to plan opportunities to mark, observe, listen and discuss with pupils.
- A wide range of different assessment techniques must be used in order to help
all pupils show what they know, understand and can do.

- Assessment opportunities need to be built into planning and teaching.
- Permanent evidence needs to be retained - recording the results of discussion on pupils' work.
- Marking policy
- The importance of giving feedback to pupils
- The need to hold agreement trials.
- Regular use of assessment data.
- Revision of science orders means that the department is reviewing constantly their explorations and investigations for Sc 1
- Regular agreement trialling.
- Pupil progress record to give pupils feedback and feed forward.
- Formative records summated twice a year.
- Review of pupil progress twice a year.
- Manageability of formative and summative records.

Approximately one term before the end of Key Stage 3 in February 1992 SEAC produced the first volume of Pupils' Work Assessed - Science. This was an anthology of pupils work covering attainment targets 2-4 of the December 1991 Science Order. SEAC asked teachers to bear the following points in mind when reading the materials.

- There are frequently several parts to a statement of attainment. In such cases, teachers will need evidence from a range of contexts before arriving at a judgement about a pupil's level of attainments.
- Many of the pieces of work address only a single statement of attainment. This is a reflection of the fact that statements of attainment specify context and do
not necessarily involve a precise line of progression from one level to the next.
(SEAC 1992, p.4)

Each extract of pupil’s work was accompanied by a commentary, which described the context in which the work was done, analysed the evidence, judged the level of attainment and suggested ways forward for the individual concerned.

SEAC said this format was adopted to ensure maximum flexibility for those using the materials in agreement trials. It allows teachers and others to consider the context and try to assess the work without being influenced by the judgement of level in the commentary.

SEAC in the anthology notes that

“the statements of attainment in the Science Order vary in their degree of complexity. The anthology includes pupils’ work that exemplifies some statements of attainment which are relatively simple as well as ones that are more complex”.
(SEAC 1992, p.4)

Finally nine weeks before the tests in February 1992 SEAC produced Key Stage 3 School Assessment Folder for Science (Part 2) which gave guidance on end of key stage teacher assessment. This folder consisted of sixty five pages of guidance covering nine sections.

Contents Key Stage 3 School Assessment Folder
Science (Part Two)

Section 1 End of key stage Teacher Assessment.
Section 2 Relating the old and new attainment targets in science.
Science 3 Assessing science attainment target 1: Scientific investigation.
Section 4 Managing tests.
Section 5 Welsh versions of the tests.
Section 6 Pupils with special educational needs.
Section 7 Pupils who are not fluent in English or Welsh.
Section 8 Quality Audit.
Section 9 Sample test items and mark schemes.
In this guidance SEAC said that records should be in a format that helps teachers to decide on end of key stage levels for each pupil against each attainment target. SEAC again stated that the question of how to record is a matter of professional judgement but whatever approach is taken, recording should not be unwieldy or time consuming or get in the way of teaching and learning. SEAC also reminded teachers that evidence of pupils' attainment in relation to all attainment targets should be retained, although the amount and range of this evidence is a matter for professional judgement.

In outlining what needed to be done by the end of the key stage (30 June 1992) SEAC said

- By the end of the Spring term teachers will need to make an initial estimate of year 9 pupils' levels in each attainment target to be covered by the tests (Sc2, 3 and 4). This will help teachers to order the correct number of tests for pupils at different levels.

- Before coming to final Teacher Assessment levels at the end of June, teachers will need to discuss judgements of pupils' work with colleagues in order to ensure that the statements of attainment are being interpreted in a consistent way. For Teacher Assessment purposes there are no regulations stating how to reach agreement. Teachers will use their professional judgement about their pupils' achievements.

- All final Teacher Assessment levels will need to be decided in relation to the new attainment targets. It will not normally be necessary to re-assess pupils against the new targets. Rather, teachers will need to translate existing records kept on the old attainment targets into levels in the new attainment targets.

In this guidance SEAC drew the distinction between the different nature of teacher assessment and the tests. The Teacher Assessment levels represent information built up over the three years of the key stage while the tests sample those achievements at the end of the key stage. This is why the results are recorded separately.

In the guidance for Assessing Science Attainment Target 1: Scientific Investigation (Sc1).
SEAC categorises practical activities as being of four broad types:

- basic skills exercises,
- observation exercises,
- illustrative work,
- and investigations

and whilst each plays its part in science teaching and learning, it is a requirement that the assessment of Sc1 should be carried out in the context of Scientific Investigations. Investigations include

- planning,
- predicting,
- hypothesising,
- designing,
- carrying out,
- interpreting results,
- evaluating evidence,
- drawing inferences
- and communicating plans, tasks, procedures and results.

Each level in Sc1 is defined by statements of attainment, arranged into three strands:

- question, predict and hypothesise;

  observe, measure and manipulate variables, and
because the statements at each level are prefaced by the words 'pupils should carry out investigations in which they ...' all of the abilities that pupils need to demonstrate have therefore to be assessed in the context of whole investigations. This does not mean that each investigation has to offer the opportunity to assess all three strands. Nor does it necessarily mean that where an investigation allows all strands to be assessed, the teacher has to assess them all. It may be more manageable to record a pupil's performance on each strand in the context of different investigation.

The remainder of part 2 was concerned with matters directly related to the tests. In the guidance on Sc1 teachers are directed to further information in Assessment matters No.6: Planning and carrying out investigations. A booklet for teachers - SEAC. Evaluation and Monitoring Unit November 1991.

- The other SEAC publications on assessment and

Science teachers as a result of GCSE, had considerable experience of assessing practical activity but this guidance with its atomistic approach seemed to be defining scientific methodology in a completely different way than previously. This assessment structure was so complex and it is difficult to see how it would help teaching and learning. The fears of many of an assessment led curriculum were apparently well-founded.

In the introductory “points to note” section of the guidance, SEAC explained how the new Sc1 differed from the old.

- There are fewer, but more general, statements of attainment arranged in strands.
- There is a much stronger link with scientific knowledge and understanding, particularly in strands (i) and (iii).
- The programmes of study for Sc1 are strengthened by the inclusion of aspects of information technology and the evaluation of investigations.
- The need for assessment to be carried out in the context of whole investigation
has been clarified.

This section of guidance goes on to offer advice on how to build investigations into schemes of work, how pupils can be allowed to show attainment at appropriate levels, how to identify progression in concepts and variables and in complexity of results. This advice would be helpful in forthcoming years but it was not at all useful at this stage other than to further undermine the flagging confidence of teachers and to further enhance the dependency culture! Teachers were frequently heard to say “why do they not just tell us what to do and we will get on with it!”

In the School Assessment Folder (Part 3): Materials to support the assessment of Sc1: Scientific Investigation - Published in March 1992, six weeks before the end of the key stage there were a further twenty two pages of guidance largely about Sc1 and a little about update on Quality Audit and Tests.

Section 5 offered guidance on managing the assessment of Sc1 and suggested the use of prompt sheets, checklists, self-assessment and how to respond to pupils difficulties.

Section 6 offered guidance on making judgements and how to assess individuals during groupwork and reminded teachers that pupils performance in investigation may vary markedly from one context to another. It is therefore necessary to assess pupils on a number of investigations in a range of contexts taken from the programmes of study for Sc2-4 and since not all investigations cover all strands equally well, a number of investigations will also be necessary to ensure that pupils are able to show their attainment in each strand of Sc1. The guidance also included examples of pupils work on Sc1 and the commentary showed how the teacher could use the evidence to make a judgement and assign a piece of work to a particular level for a particular strand. The guidance also includes a very clear and helpful prompt sheet which could be used by pupils in planning their investigation and also in writing their report and a self assessment sheet.

Teachers started out implementing the National Curriculum without any clear details about what would be required from them and their pupils at the end of the key stage. This meant there was considerable confusion and a large investment in time and effort in trying to implement assessment strategies based on what they thought might be expected of them. The influence of the both TGAT and SWG was clearly evident.

SEAC, which should have set out clearly from the outset what would be required by pupils and teachers and then left it to teachers to decide how they would approach
assessment and meet their accountabilities, instead sent an enormous volume of documents to schools which tried to dictate to schools how the curriculum should be taught and assessed. This only added to the schools difficulties. There did seem to be considerable confusion about the roles of bodies such as SEAC, NCC during this period.

In the latter stages of Key Stage 3 there was no lack of advice, but what purpose could it serve other than to further de-skill the teacher!

**Additional non-Statutory Guidance for the New Orders**

In addition to coping with the demands of implementing the National Curriculum and its assessment, schools were also faced with other documentation all of which was attempting to communicate to teachers some kind of vision of the curriculum.

As has been mentioned in chapter 2 the Science Orders were revised before the first cohort had completed key stage 3 and whilst the date of implementation was August 1992 (when the first cohort would have completed the key stage 3) the end of key stage tests were based on the new Orders and the teachers were teaching from the old orders. In addition to producing new Orders, Supplementary Non-Statutory Guidance for Science was produced by the NCC in 1991. This additional Non-Statutory Guidance was produced to:

- explain the changes that had been made;
- help teachers modify their schemes of work;
- describe the strands of progression which are the basis of the new ATs;
- guide teachers in the use of the SoA in assessment and record keeping.

Circular 17/19 the National Curriculum: Mathematics and Science Order under section 4 says that the new orders embody only minor changes in curriculum context. Schemes of work based on the 1989 Orders for the Science should therefore require little alteration and in the Science Non-Statutory Guidance (1991).

1. "Schemes of work based on the PoS in the 1989 Science Order should not need much amendment. The science content to be taught has remained almost the same."
In addition to the subject-specific guidance from NCC and SEAC schools also had the guidance contained in such documents as Curriculum Guidance 3 - The Whole Curriculum (NCC 1990), which stated that the “full potential of the 10 subjects (of the National Curriculum) will only be realised if, in curriculum planning schools seek to identify the considerable overlaps which exist both in context and in skills. There is in effect an opportunity for schools to carry out context and audit skills. Inter-departmental planning can lead to a more coherent development of skills and the reduction of wasted time and overloading caused by duplication of effort.” This led many schools to use valuable training time to map the curriculum and many schools felt an added sense of frustration as this sort of curriculum planning was regarded by many as something the NCC should have done. The document then goes on to cross-curricular elements which are categorised into three aspects:

- dimensions
- skills
- themes.

The dimensions refer to equality of opportunity, multicultural education, pupils with special educational needs, preparation for adult life and the European Dimension. The core skills identified by NCC are:

- communication
- numeracy
- study
- problem-solving
- personal and social
- information technology.

The National Curriculum Council considers it absolutely essential that these skills are fostered across the whole curriculum in a measured and planned way.

In addition to the dimensions and skills the National Curriculum Council identified five themes which whilst not being conclusive are probably recognised by most people as pre-eminent.

Economic and Industrial Understanding
Careers Education and Guidance
Health Education
Education for Citizenship
Environmental Education

The National Curriculum Council in this document outlined five ways in which secondary school might endeavour to include the themes in their work. The approach suggested areas for schools to become involved in whole curriculum planning and three steps in the process were outlined.

- Curriculum audit.
- Production of whole curriculum development plan.
- Implementation of the plan.

Summary
The vision of the curriculum was therefore largely communicated to schools and teachers through written documents from the National Curriculum Council (NCC) from the Schools Examination and Assessment Council (SEAC) and from the groups which wrote the Non-Statutory Guidance. Schools had almost no time to read those documents and apparently little inclination.

Whatever vision schools thought they had for the curriculum at the start of implementation in 1989, by the end of 1992 when schools took part in the Voluntary Pilot for the end of Key Stage 3 there were several additional visions being shaped. The written materials could at best be likened to distance learning materials, and whereas it might have been anticipated that these materials would be supported and mediated at a local level by an advisory service working with teachers, and whilst it is true that some of the materials were used at training sessions, the local management requirement to devolve monies to schools and the requirements to devolve all the money for teacher release for training, meant that at best each school sent one teacher to each aspect of training and usually a different teacher at that, some schools sent no one. At the end of the Key Stage 3 in 1992 had the schools been involved in a gradual evolution based on current good practice, a radical change or was the implementation of the National Curriculum taking place at all? Were there tensions between a range of visions of change and the reality of change? There was certainly a potential for misunderstanding of the change and from the outset a culture in which teachers were experiencing confusion and uncertainty and where these seeds of a dependency culture were being sown.
CHAPTER FIVE

Studying the Change

Science in the National Curriculum at Key Stage 3

Preview

The previous chapters have highlighted the tensions between continuity and change both at the vision creation stage of the National Curriculum and subsequently as schools endeavoured to implement the National Curriculum. The reassurances of the Science Working Group about the curriculum building on current good practice, and the fact that the case study school were situated in an LEA which was in the forefront of national thinking about education meant that teachers in the case study schools should have been in the optimum condition for this proposed evolution to take place.

The research looked at the implementation of the National Curriculum Science at Key Stage 3, 1989 - 1992. The research focused on a period just prior to the introduction of the National Curriculum Science (Summer 1989) until the voluntary pilot in the end of Key Stage 3 tests (Summer 1992). The research looked at the whole process of the change, what were the factors which brought about a need for change, that is the National Curriculum, how the National Curriculum for Science was created and the nature of the change, how were schools placed to cope with the change, how schools were informed about the change, and how schools actually managed the change. The research then focuses on an analysis of this change process and concludes with an identification of the aspects of policy and practice which supported or impeded the implementation of the National Curriculum Science.

Aims of the Research

- To research the climate which brought about the National Curriculum.

- To understand the nature of the change proposed - what was the vision for the curriculum?

- How was this vision communicated?
• To determine the base on which the change was built.

• To find out how schools planned and implemented the Science National Curriculum at Key Stage 3.

• To find out how schools ensured that teachers had a shared understanding of the Statements of Attainment and how they developed a consistent understanding and interpretation of pupils' achievements so that standards of attainment were reliable and valid with the same schools.

• To find out how schools were informed about, and planned to build on, pupils' previous learning experiences in Science.

• To determine how schools assessed pupils and what evidence teachers were collecting about pupil achievement and how this evidence was used in planning the momentum and progression achieved by the individual, group or class.

• To consider the relationship between Teacher Assessment and the results of the tests at the end of Key Stage 3.

Purposes

• To identify aspects of policy and practice which has supported the introduction and the implementation of the National Curriculum Science.

The study aimed to collect evidence on a number of issues but specifically:

• why a National Curriculum was proposed?

• an examination of how the Science National Curriculum was shaped through the period of setting up the Science Working Group through to the revised Orders for Science;

• what was science education like in the LEA in which the case study schools were located prior to the National Curriculum;

• how was the implementation of the National Curriculum supported nationally and locally;
- how schools used transfer documents from feeder primary schools to ensure improved continuity and progression;

- the balance of the science curriculum in the planning of schemes of work and schemes of work in practice;

- assessment strategies, techniques and practice used by schools, particularly looking at the feedback given to pupils and the use of records for planning;

- how departments interpreted statements of attainment to ensure common goals for teaching and learning;

- how and when departments held agreement trials to standardise;

- how departments made decisions about appropriate level of entry to the tiers of tests for each child;

- the means by which teachers, heads of department and schools monitor and record pupil progress;

- the relationship between teacher assessment (TA) of pupils’ attainment and the outcomes at the end of the Key Stage 3 voluntary pilot.

(During the period of the implementation science teachers, along with mathematics teachers have been faced with nine documents relating to the National Curriculum in Science, from the original proposals for science to the revised Orders for science published in late 1991. The initial twenty two attainment targets proposed were reduced to seventeen in the Orders for science and in the revised Orders to four. This has inevitably led to some frustration and disillusionment on the part of science teachers and it has gone some way to slowing the pace of change).

**Research Methods**

- Reading of literature from 1976 onwards (Ruskin Speech) to understand why a National Curriculum was proposed.

- Reading and analysis of the Science Working Group reports and the responses to the consultation processes involved.
• Literature searches including LEA Curriculum documents, LEA inspection reports and reports from HMI and others.

• An analysis of all the guidance produced to enable schools to implement the National Curriculum by the NCC and SEAC during the period from the non-Statutory Guidance to the guidance and instructions for the end of Key Stage tests.

• Case studies of originally seven and then six schools with an LEA.

The case study approach was chosen because it gives the opportunity for a study in some depth within a limited time scale in order to identify, or attempt to identify, the various interactive processes at work.

Bassey takes the view

"an important criterion for judging the merit of a case study is the extent to which the details are sufficient and appropriate for a teacher working in a similar situation to relate his decision making to that described in the case study. The relatibility of a case study is more important than its generalisability".

(Bassey 1981-85, p.85)

The main thrust of the case studies were interviews with various people and this approach was chosen because of its adaptability. It enabled follow up to ideas and to probe responses further. Of course, this approach is highly subjective and there is the inevitable danger of bias. There is also the eagerness of the respondent to please the interviewer and the tendency of the interviewer to seek out the answers that support pre-conceived notions. Throughout the research I was aware of these difficulties and tried to minimise their effect by cross-checking and by reading widely to gain impressions from a broad range of sources. For all interviews I wrote to the schools in advance and sought permission and then I arranged convenient interview times. I phoned interviewees in advance and talked over with them the questions I intended to ask and also to explain the purposes of the research. The interviews took place over the three years as appropriate and the majority of the interviews took place at the interviewee's school.
The same set of questions was used for all case study schools and I recorded notes at the time which I immediately wrote up afterwards and then verified with the respondents.

Selection of case study schools

A representative sample of six secondary schools out of a total of twenty were chosen as case study schools. These included Schools involved in the Graded Assessment in Science Project (GASP) and non-Gasp schools, single sex and mixed schools in a LEA which was considered to be in the forefront nationally in publishing curricular guidelines in 1984 and revising them in 1988 for pupils aged 5-16. The LEA had used standardised tests to assess the attainment of pupils aged 7, 11 and 14, publishing the results of these tests annually since 1985.

Initially, seven schools were chosen for the study, they included.

School A
- An 11-18 Girls voluntary aided school which taught separate sciences from Y7 - a former Grammar school, heavily over-subscribed with a long tradition of excellent examination results.

School B
- A large 11-16 Mixed High School which had been a new school in the mid 70's with an intake skewed to the more able and with a Head of Department who was very experienced.

School C
- An 11-16 Mixed High School which had been a pilot for the Graded Assessment in Science Project (GASP) and which had recently changed its status from an 11-14 school to an 11-16 school, with a relatively inexperienced Head of Science and a department with a high turnover of staff.
School D

- An 11-16 Girls School - which had recently changed status from an 11-14 High School with a Head of Department in post a year and which introduced the Graded Assessment in Science Project - but with several other very experienced department members - which had introduced GASP at the same time as implementing the National Curriculum.

School E

- An 11-16 Mixed High School with a relatively inexperienced Head of Department, several newly qualified teachers and a very good intake and examination results, the school had also recently been re-organised.

School F

- An 11-16 Mixed High School with a newly appointed Head of Science and a relatively inexperienced department. The school had been a pilot for the GASP project but had subsequently abandoned it. This school had also been very recently re-organised from an 11-14 school.

School G

- An 11-16 Girls High School which had been the first school to be re-organised and which had a history of success in encouraging girls to study physical science. The Head of Department of this school changed during the period of research and a relatively inexperienced although former member of the department was appointed to lead the department.

The schools were chosen to give a representative sample of schools within the LEA. Further details of each school now follows.
School A

This school was chosen because it was an 11-18 school and the science department was organised along very traditional lines with separate Heads of Biology and Physics under the loose leadership of the Head of Chemistry, who was also the Head of Department. This school was greatly over subscribed and had an intake more like that of a traditional Girls’ Grammar School. Despite being enthusiastic initially to be involved in the research, the Head of Department suffered long term illness during the period of the research and apart from very initial discussions they did not take part in the research.

School B

School B is an eight form of entry mixed 11-16 high school which is heavily oversubscribed and which is situated in a prosperous and leafy part of the LEA. The school was a new school in 1976 and is housed in purpose built accommodation. The school achieves excellent examination results. The department was led by an experienced Head of Department who had also been a Head of Science in a previous school. The school had a stable staff and apart from one newly qualified teacher all members of the department had considerable experience and were very well qualified.

This school taught pupils in mixed ability groups (apart from one small group of about 10 pupils with Special Needs) for both Y7 and 8, but pupils were streamed in Y9. Prior to the implementation of the National Curriculum the department had introduced a course based on the Warwick Process Science and the department was very committed to this approach.

In years 10 and 11, the school offered both double and single science and approximately half the pupils opted for double science. The department enjoyed excellent purpose built facilities which included five labs, 3 lecture rooms, 5 prep rooms and an animal house. The department was serviced by several technicians. Nine teachers taught science and at the time of the research the Head of Department was assisted by a Deputy Head of Department and two other post holders, one with responsibility for assessment and the other responsible for lower school science. Science occupied ten per cent of curriculum time in Y7, twelve and half per cent in Y8 and fifteen per cent in Y9.
School C

School C is an 11-16 High School which had changed from an 11-14 school and had prepared its first candidates for GCSE in 1988. The science department had been a pilot for the GASP project and had been very successful in motivating pupils and achieving good results. The structure and organisation of the curriculum revolved around the GASP project. The department was led by a recently appointed Head of Science and several of the department were newly qualified teachers.

Pupils were taught in mixed ability groups in Y7 and 8 and in streamed classes in Y9. The school taught integrated science throughout the five years and the courses the school used were largely home grown. In years 10 and 11 all pupils studied Double Science for twenty per cent of curriculum time. Pupils in Y7, 8 and 9 studied science for ten per cent of curriculum time. The science department was housed in six labs and two had been recently upgraded. The Head of Department was supported by two post holders - a Deputy Head of Science and a teacher in charge of GASP. At the time of the research the other members of the department were either newly qualified or teachers with one or two years experience. The department was well served by technicians.

School D

School D is an 11-16 Girls four form entry school which had been a 11-14 school and had prepared its first candidates for GCSE in 1988. The intake of the school was multi-cultural with a large proportion of girls coming from the Asian community. The Head of Science was recently appointed and had come from an 14-18 school. Pupils were taught integrated science in mixed ability groups in Y7 and Y8 and in banded groups in Y9. Pupils spent fifteen per cent of curriculum time studying science in these years. With the introduction of the National Curriculum the school had introduced a new lower school course based on Active Science and they had also introduced the GASP scheme.

Pupils in Y10 and 11 were offered modular courses in both double and single science and at the start of the research more pupils were opting for single science than double, although this changed during the period of the research. The department was housed in four labs, two of which had been upgraded in the borough’s scheme. Apart from the Head of Science no other teacher held a post of responsibility in science. All members of the department had many years teacher experience largely teaching their own specialist subject but the Head of Department was the only one with significant experience of preparing pupils for public examinations.
School E

School E is a six form entry 11-16 mixed high school which had also been an 11-14 school and had entered its first cohort of pupils for GCSE in the summer of 1988. The school is over subscribed and situated in a prosperous part of the borough. The Head of Department had been appointed recently, although he had worked in the school for several years previously and all other members of the department were relatively inexperienced.

Pupils are streamed for science in years 7-9 and had ten percent of curriculum time in Y7 and 8 and fifteen percent in year 9. The Key Stage 3 course was based on the Oxford Science Programme. The school offered a variety of courses at GCSE, single science, double science and separate sciences.

The science department was housed in 6 labs and had a full-time and a part-time technician. Eight teachers taught science and the Head of Science was supported by two post holders, one teacher in charge of Upper school science and one in charge of Lower school science.

School F

School F was also a former 11-14 school which had changed to an 11-16 high school and had prepared its first candidates for GCSE in 1988. The School had a newly appointed Head of Science who had been on a teacher exchange to Australia in the year immediately preceding the implementation of the National Curriculum. The department had been heavily committed to GASP and also to the LEA Record of Achievement pilot - but had decided to drop the GASP scheme on the introduction of the National Curriculum. The school taught pupils integrated science in mixed ability groups in Y7 and pupils were streamed in Y8 and Y9. Pupils studied science for approximately twelve and a half percent of the time in years 7-9. The Y7 and Y8 courses were home grown and the Y9 course was based on Nuffield 13-16 course. All pupils in Y10 and 11 studied double science for twenty percent of curriculum time.

The department was housed in six labs with two prep rooms. Two of the labs had recently been refurbished under the borough’s upgrading scheme. In addition to the Head of Science, two teachers had post of responsibility - the Deputy Head of Science and a teacher with responsibility for Key Stage 3 assessment.
School G

School G was an oversubscribed girls' school which had a multi-cultural intake. The school had four forms of entry and was the first school in the LEA to be re-organised to an 11-16 high school. The school had entered its first candidates for O levels and CSEs in 1986. The school had been very successful in encouraging girls to study the physical sciences in years 10 and 11. The department was housed in a purpose build block of four labs and two prep rooms which had been completed in August 1985. At the start of the research, the department was led by an experienced Head of Science but during the period of the research she left to take up a post as an Adviser, a teacher who had worked in the department some three years previously had been appointed as Head of Department.

In years 7 and 8 pupils were taught science in flexible sets for ten percent of curriculum time and in Y9 pupils were taught in sets for about 12.5% of curriculum time. The course in years 7-9 were based on Nuffield Co-ordinated Science and this was organised so that subject specialists taught their own subject as a discrete subject emphasising the links between the subjects. In addition to the Head of Department, there were two additional posts of responsibility, one as second in the science department and one as Head of Biology. A further teacher was a Y7 co-ordinator and did the job without a responsibility allowance. Six teachers taught in the department and they were serviced by two technicians.

The Case Studies took the form of:

- interviews, at least two, with the Head of Department and/or Key Stage 3 Science Co-ordinator and at least one other teacher teaching science at Key Stage 3;
- examination of departmental documentation;
- occasionally, attendance at departmental meetings where decisions were taken which were relevant to the study;
- analysis of evaluation sheets completed by teachers when attending in-service training for voluntary pilot at the end of Key Stage 3 Assessment tests.
The Interviews

At the outset of the research departments were visited and general data about the department was gathered and initial enquiries were made about:

- how will the department implement the National Curriculum for science?
- will schemes of work need revising and how will this be done?
- what forms of assessment will the department use?
- will the department use a published scheme?

During the course of the research departments were visited again to find out:

- how schemes of work were working in practice;
- how departments were assessing pupils.

The interview also probed how departments were interpreting the Programme of Study and the Attainment Targets to ensure consistency for teaching and learning.

Head of departments and others were also asked about the means by which teachers, heads of departments and the school monitor and record pupils' progress. Enquiries were also made about whether the department had held any agreement trials.

Just prior to the end of the Key Stage 3 tests interviewees were asked how the department made its decisions about the appropriate level of entry to the tiers of the tests for each child and after the tests, interviewees were contacted and asked about the relationship between the teacher assessment and the results of the end of Key Stage 3 tests.

Departmental documentation was also made available and I was able to observe several departmental meetings where schemes of work were discussed or agreement trials were held.

Use of other documentary evidence

The annual report of the Chief Inspector Education of the LEA during the period of the research was used and during the latter part of the research the termly reports were
drawn upon. In the case of two schools the published inspection reports were used. The evaluation sheets completed by teachers on in-service for the end of Key Stage tests were also used.

Other documents used

During the period of the research an enormous amount of guidance documentation was produced by SEAC and the NCC all of this was read and used in the research. This guidance which is analysed elsewhere in this report focused on the content of the changes required by the implementation of the National Curriculum and there was almost no emphasis on the processes of the change or discussion about the philosophy of science education.

Literature searches.

The annual reports of HMI on the implementation of the Science National Curriculum and the reports on Assessment, Recording and Reporting were used. Documents from both the Science Working Group and TGAT and all the documents from NCC and SEAC were used. In addition articles in the Times Education Supplement during this period were researched and a range of books produced during this period were also used.

Summary

This chapter outlined the scope of the research undertaken, its purposes and the approach adopted. It also provided information on why the case study schools were chosen and gave information about the structure and organisation of each department.
CHAPTER SIX

The Changes in Practice

Preview

In this chapter the approaches of the case study schools in implementing the National Curriculum in Science at Key Stage 3 are outlined. This preview justifies why certain aspects of the research were undertaken. Schools were asked how they built on pupils’ previous learning experience in science because Key Stage 3 sits between six years of primary science and the demands of Key Stage 4 and GCSE and whilst the amount of time devoted to science in primary schools varies from between 5% to 25% and the quality of that science teaching is variable, it is abundantly clear that when pupils arrive at Y7 they are not empty vessels waiting to be filled. The work of the Children’s Learning in Science Project (CLIS) has emphasised that the constructs that children create in order to explain their scientific experiences and to further develop their scientific knowledge and understanding must be taken into account if in subsequent learning pupils are to make progress.

In the document Science 5-16: A Statement of Policy (published March 1985) it stated that

"Science should have a place in the education of all pupils of compulsory school age, whether or not they are likely to go on to follow a career in science or technology. All pupils should be properly introduced to science in the primary schools and all pupils should continue to study a broad science programme, well suited to their abilities and aptitudes, throughout the first five years of secondary education”.

(Science 5-16: A Statement of Policy 1985, p.1)

As early as 1982 the consultative paper Science Education in Schools proposed that science education should be regarded as a continuum from 5 to 16.

and also in Science 5-16: A Statement of Policy.

"The development of science in primary school imposes an added responsibility on the schools to which the pupils transfer. They have to ensure, if the goal of making science from 5-16 a continuum is to be realised, that the pupils early
experience is neither ignored nor undervalued but reinforced and exploited in their subsequent work. Suitable arrangements for ensuring continuity and progression are therefore essential.”

(Science 5-16: A Statement of Policy 1985, p.11)

Schools were also asked how they went about planning Schemes of Work for Key Stage 3. The non-Statutory Guidance for Science published in 1989.

“provided a mechanism that schools can use to produce a scheme of work which covers the requirements for science, as described in the Statutory Order. It emphasises the scope that teachers have in determining the range, style and organisation of the teaching programme and state that the record of pupils' science education will form the basis of decision making on the content, pitch, and pace which will characterise a scheme of work.”

(NSG Science 1989, p.B1)

In the non-Statutory Guidance a clear statement is made that

“the programmes of study form the basis for developing a scheme of work”

(NSG Science 1989, p.B1)

and explains that

“statements of attainment can be used subsequently to sharpen the focus of the schemes. They will help to ensure that pupils are offered opportunities to attain at a particular level”.

(Ibid)

The Non-Statutory Guidance justifies the need for a scheme of work and states that

“in order to provide a coherent structure for the science curriculum in a school, it is essential that teachers have a shared vision of the purpose of their teaching. The development of the scheme of work, by teachers working together is a mechanism whereby a co-ordinated approach can be achieved”.

(NSG 1989, p.B1)

Whilst schools set out their intended curriculum in policy documents, department handbooks and schemes of work, in practice it is the class teacher who has responsibility for ensuring that the planned, delivered and the received curriculum articulate together, though the teaching and learning activities to ensure that pupils receive the curriculum to
which they are entitled. This places a responsibility on the Head of Department to ensure all members of the department work together to develop an understanding and to shape and develop professional judgement. In this way the work of a department will develop considerably and by sharing ideas and experiences instead of constraining teachers freedom will develop confidence and ensure a more appropriate provision and a match with the learner’s needs.

“The curriculum is not something that can be set down on paper, and given to the whole body of teachers with an instruction to put it into effect in the expectation that schools will become as a result more uniform in what they teach and more effective in teaching it”.

(Leonard 1988, p.2)

“Assessment is at the heart of the learning process”.

(TGAT 1987, para 3)

and

“Teachers of all levels assess children on a regular basis to establish what has been learned, how quickly they can move on to the next theme and where repetition or remedial action is required. Their assessments do not carry the weight of national legislation, their results are not always made known to the pupils, let alone to parents/carers, the headteacher of LEA or the DES.”

With regard to assessment strategies, the TGAT report stated that performed in this way

“assessment is simply an integral part of good teaching”

and the non-Statutory Guidance reiterated and stressed that

“teachers assessment of a pupil’s current achievements and judgements about their potential is very important and should be considered in all plans for activities and in the organisation of class structure”.

(NSG Science 1989)

In the light of the foregoing the case study schools were therefore asked about their approaches to assessment.
In the SEAC leaflet about assessment at Key Stage 3 with regard to interpretation of Statements of Attainment.

“Teachers must make their own judgements about their pupils’ achievements in relation to attainment targets and statements of attainment.” and emphasises that “discussion with other teachers about how and why judgements have been made are important in trying to achieve more consistent interpretations of statements of attainment.”

(SEAC 1991 Leaflet Assessment Key Stage 3)

How schools did this was featured in the case studies.

With regard to relationships between Teacher Assessment and the outcomes of the end of Key Stage 3 voluntary pilot, Paul Black (Chair of the TGAT) in the Times Educational Supplement of 23 April 1994 wrote:

“there is a prima facie case that the present SATs are of low reliability. Programmes to evaluate their reliability and that of the teacher’s assessment must be undertaken and their results must be published. I believe it would then become clear that the best way to produce results that can be trustworthy will be to design and apply SATs to calibrate, rather than supplant, teachers assessment. Then we might have a system which supports teachers commitment to improve learning and which relies upon their professional judgements about their own pupils.”

(Black 1994 TES 23 April 1994)

Schools were informed about how to implement the various aspects of the National Curriculum through a range of written materials produced by both the National Curriculum Council (NCC) and the Schools Examination and Assessment Council (SEAC) and these were discussed in Chapter 3. Some of these materials were also used at LEA level for the basis of their in-service training. At the time when in-service training was probably most necessary schools were coping with changes in INSET funding because of the introduction of Local Management of Schools (LMS) and also because of the reduction in the number of Advisory Staff.

“The implementation of the National Curriculum has taken the form of a tidal wave of documentation.”

(Coulby and Bash 1991, p.14)
How the schools used this documentation is now featured in the case studies.

In the year prior to the introduction of the National Curriculum schools had just seen their first cohort through the GCSE and teachers were also asked if the experience of GCSE had helped schools to carry out Agreement Trials in order to standards judgements.
CASE STUDY 1

School B

All teachers in the department are teaching the National Curriculum at Key Stage 3 and all were involved with Yr 9 pupils in the academic year 1991/92. The school has one member of staff designated an assessment co-ordinator and another member of staff responsible for the KS3 Science Curriculum.

Use of Transfer Documents.

The documents provided by feeder primary schools giving details of pupils current achievement in science were not used by the department because they were unmanageable. The information from individual schools was very variable and the levels attributed to pupils work were far too high. Pupils were allocated to classes by the Yr 7 Year Tutor on the basis of the reading and mathematics scores which have been in use in the authority for several years. The department assumed that pupils had done very little science work at primary school and started more or less from scratch.

Planning Schemes of Work for Key Stage 3.

The school used the flow-chart in the science Non-Statutory Guidance and using existing schemes of work identified gaps using a matrix of the current scheme against the seventeen attainment targets. This matrix also identified the overlaps and cross-curricular links with geography, technology and history to be identified and some negotiations took place with these departments about how these links could be tackled. There was a considerable degree of goodwill and efforts were made to work together, this worked well initially but foundered when the other subjects came on line as it was then difficult to synchronise approaches and the time and opportunity for liaison evaporated in the face of demands for the subjects to implement their orders.

The original scheme of work was largely based on the Warwick Process Science Course and this was the framework for the new Scheme of Work for Yr 7 and 8. Considerable content has to be added to the course with some reduction of emphasis on the processes of science which was a major feature of the original course. The Yr 9 course was totally home grown.
Schemes of Work in Practice.

Teachers were very pleased to have the support of the Scheme of Work as they came to terms with the demands of the National Curriculum and used it almost on 'automatic pilot' particularly in the early stages. The Key Stage 3 Co-ordinator also collated files of worksheets and guidance which teachers were able to "dip into" as they needed. This meant that there was opportunities for inconsistencies in the curriculum provided to pupils taught by different teachers. In light of the experience of the first run through and the changes in the science orders, the schemes of work have been reviewed and revised in Summer '92. This revision was completed by the Head of Department and the Key Stage 3 Co-ordinator in discussion with the other members of the department. The Scheme of Work consists of very brief lesson outlines supported by information files and worksheets. The Scheme of Work refers to Attainment Targets but does not give details of specific Statements of Attainments being addressed nor does it give details of the desired learning which should take place or any information about assessment procedures. Teachers are required individually to complete lesson planning pro-formas specifying the lesson objectives, the desired outcomes, teaching notes, reinforcement, extension, resource requirements, homework and any particular information required for COSHH.

Assessment Strategies.

Assessment was almost exclusively by end of unit tests which were designed in-house and which were intended to assess attainment against particular Statements of Attainment. They had been rather limited in their scope and time consuming to mark and administer and the department is investigating the use of multiple choice questions which could be marked using the optical mark reader. The department does have some reservations about the use of multiple choice papers but will experiment to gauge their potential. The department has serious reservations about their approach to Sc1 and felt that the investigations used did not meet requirements of Sc1 fully, particularly in respect of pupils asking their own questions and then following this by planning suitable explorations involving the identification and control of variables. The current practice is for all pupils to do one teacher assessed Sc1 investigation per term across the Key Stage. The Head of Department would like to increase the number of explorations carried out and assessed but time factors are inhibiting this increase at the moment. It is intended that a second exploration per term will be incorporated into the Scheme of Work later on.
Interpretation of Statements of Attainment.

The department relies on the individual professional judgement of teachers to interpret the Statements of Attainment through their individual lesson plans whilst the department scheme reflects the planned opportunity to cover all the Statements of Attainment, so in essence there is no corporate agreement about interpretation of SOAs.

Standardisation and Agreement Trialling.

Throughout and at the end of the Key Stage the department did not take part in any standardisation of pupils work nor of any agreement trialling other than the training in agreement trialling organised by the LEA in preparation for the end of Key Stage Voluntary Pilot Tests. The experience of the pilot has highlighted the need for the department to engage in agreement trials and there are plans to incorporate agreement trials as a feature of department meetings and school development days in the future.

Decisions about appropriate entry to tier of end of Key Stage Assessment.

The department made decisions about the tier of test each pupil would take on the basis of professional judgement. The department had in some cases over-estimated the level of entry for some pupils particularly in the 5-8 band, as a result several pupils had a W (working towards level 1), where pupils failed to reach the lowest level of the tier of the paper then they were awarded a W overall for their Science Score. The department had requested permission to open the papers in advance in order to prepare appropriately for children with English as a second language or for pupils with specific learning difficulties. At this stage the department did not anticipate any difficulties with the papers and did not make any last minute changes to pupils level of test.

Monitoring Pupil Progress and Recording Pupils Progress.

The Head of Department is allocated one hour per week for monitoring purposes. This is used by Head of Department in lesson observation and sometimes team teaching. Where ever possible discussions take place with the teachers in the department afterwards and the observations and issues are discussed at departmental meetings.

The Department designed a master record sheet per pupil for the whole Key Stage. This covered all Attainment Targets and Statements of Attainment from level 2 to level 7 and consisted of a separate box which the teacher could mark according to an agreed code if pupils had covered a Statement of Attainment or if the pupil had shown evidence of
attaining a particular Statement of Attainment. The reverse side of the card consisted of six sections (each representing a half-term's work) with an overall level, a mark out of 10 and an effort grade and the average mark for the teaching group and a space for teachers comment. This had proved to be unwieldy and uninformative and gradually fell into disuse. The recording system is now also under review.

Relationship between Teacher Assessment and the outcomes of the end of Key Stage 3 Voluntary Pilot.

In addition to the voluntary pilot the school also took part in annual end of year examinations as usual. The Head of Department analysed the results of both and found very little correlation. He used the analogy of the school examinations providing an "analogue" result of pupils achievement, whilst the end of Key Stage Assessment gave a "digital" view. The teacher assessment was at a very early stage of development and largely relied upon professional judgement which showed that the teachers had "estimated" pupils attainment at a higher level than the results of voluntary pilot indicated.

Use of supporting material provided by NCC and SEAC.

An enormous amount of supporting material had been sent to the school in the twelve months leading up to the end of Key Stage Assessment. It arrived at such a rate that it was impossible to keep up with the reading required and so the department had made very little use of the material. The parts of the supporting material which had been used when teachers attended INSET courses had shown the usefulness of such documents and the department would endeavour to use the documents in the future.

Inset provided and its effectiveness.

The early INSET provided by the LEA about familiarisation of the demands of the National Curriculum had been very useful and the INSET provided for the end of Key Stage Voluntary Pilot had been appropriate and pertinent. Subject specific INSET that is, Physics for the non-physicists, Astronomy and Earth Science etc. had been very useful and informative but much of the other INSET had consisted of "bring in what you have done" and had not proved to be beneficial. Many teachers wanted a lecturer type input with solutions and strategies rather than workshops or discussion groups where they were trying to come up with their own answers. There had been far too little emphasis on ScI and the school would welcome an opportunity to work with others to produce exemplars particularly for ScI which they could try out in their own school and then feedback and refine further.
Experience of GCSE and Coursework Assessment.

Most of the department were relatively inexperienced and had very little experience of marking coursework for GCSE.

Issues arising about the implementation of the change from case study.

A department comprising experienced and well qualified members of staff led by an experienced Head of Department working in a school which had an excellent intake and good examination results.

- The department did not use the transfer documents which would give information about pupils previous experience in science, but instead used reading and mathematics scores to assign pupils to teaching groups.

- Assumed pupils had done very little previous science so started from scratch.

- School adapted and modified existing scheme evolution based on Scheme - building on good practice - holding on to familiar - cultures of schools.

- Schemes of Work were used by teachers on “automatic pilot” - implications for the realities of managing change and emphasises the need for effective Schemes of Work.

- Echoing the Inspectors findings from prior to the introduction of the National Curriculum, the Scheme of Work did not give details of the desired learning which should take place nor any information about assessment procedures.

- Much of the curriculum design and subsequent teaching and learning was left to the individual teacher - which raises questions or whether there was within the school science curriculum, never mind a National Curriculum.

- Due to the reliance on end of unit tests there was a lack of opportunity to use assessment information to plan future learning. (See Inspectors findings prior to the introduction of the National Curriculum covered in Chapter 4).

- Strategies used to overcome difficulties with respect to limitations of assessment technique might address issue of manageability but would not enable the learner to demonstrate attainment in the most helpful way - this raises concerns about
the department's training for the National Curriculum and also with regard to the management of the department given the structure of the department with an assessment co-ordinator and another member of staff responsible for the Key Stage 3 curriculum.

- In the inspectors' findings prior to the introduction of the National Curriculum reference had been made for schools to move to an approach to investigative work which involved pupils in hypothesis making and testing, this was also a requirement of the National Curriculum but on reflection the department did not feel it had fully met these requirements.

- The department did not formalise in anyway opportunities to develop professional judgement about the interpretation of statements of attainment - so in essence there was no corporate agreement about the interpretation of statements of attainment and a question needs to be asked about how schools consider professional judgement is developed.

- The lack of agreement trialling and standardisation of pupils work give rise to issues about the validity and reliability of Teacher Assessments and also gives concern about the consistency of provision of the curriculum.

- The teachers were required to use "professional judgement" to make decisions about the tier of test each pupil would take. Some concerns must be raised about the nature and reliability of this "professional judgement" given that despite having the opportunity to look at the tests in advance and also having time to change the tier of paper a particular pupil took, the department did not see any need to do so. Subsequently, it showed that several pupils had been entered for a tier of test which was too challenging for them, thus the W score.

- The abandonment of the record sheet on grounds of unmanageability shows how confused and difficult many aspects of the implementation became and highlights the need for good leadership from Head of Department who has been appropriately trained and has received effective guidance at an appropriate time and who understands the purposes for any record system and its use.

- Teacher Assessment meant that teachers had "estimated" pupils attainment at a higher level than the results of the voluntary pilot indicated - this could very reasonably be explained in terms of the fact that two different types of assessment were used and that you would not necessarily expect both results to
be the same. In the case of this school because of the lack of agreement trialling, or discussion about interpretation of statements of attainment, I think it is more likely to be due to a lack of refinement and development of that range of skills known as "professional judgement."

- Due to pressure of time the department was unable to use the range of supporting material sent to the school. The department was aware of its value as some of it had been used on training courses within the LEA. This emphasises that whilst national bodies may produce guidance via what can be described as "distance learning materials" like all good distance learning materials they need to be supported, interpreted and mediated at the local level.

- Where Inset focussed sharply on clear and distinct interpretation of aspects of learning, teachers regarded it as helpful and useful. In contrast, the approach of asking people to share their experiences had not been useful. The school had expressed a willingness to work with others to produce exemplar materials for their own school - building very much on the local practice of developing GCSE assessments and also the GASP approach to explorations.

- Due to lack of experience the department was unable to benefit from the GCSE experience of marking and standardisation of GCSE coursework.
CASE STUDY 2

School C

All teachers in the department teach the National Curriculum at Key Stage 3 and most were involved with Year 9 pupils in the academic year 1991/92. Originally, the department had members of staff designated as co-ordinators for each year group and then latterly moved to a Key Stage 3 co-ordinator. The school also has one member of staff designated GASP co-ordinator. The department structure is due to change during the next academic year due to staff turnover.

Use of Transfer Documents.

The department did endeavour to use the LEA transfer documents. They were discussed at an after school meeting and then distributed to the relevant teachers who looked through them and extracted information with varying degrees of diligence. The year 7 co-ordinator took them away for a week and used the GASP (Pupils record sheet 3) PR3 to record information from the transfer document. He also went through the folders of pupils' work and by extracting salient evidence of achievement made some adjustments to the recorded starting points. There was considerable difficulty in extracting information as the feeder schools had not adopted a common approach and the school had thirty feeder schools. They were found to be unwieldy and there was considerable inconsistencies between teachers in the same school, some teachers had tried to record attainment whilst others simply recorded coverage of work. If schools could adopt a concise and consistent format the department may re-consider and alter its approach. The school marked pupils' samples of work against GASP criteria and in some cases found "decent" explorations amongst the work. The school then sent a description of GASP levels and information on children's achievements to twenty six feeder primaries and asked the schools if they wished to be kept informed of pupils progress. Only one school responded. The school is very keen to develop relationships with primary schools to ensure continuity of pupils' science education.

Planning Schemes of Work for Key Stage 3.

Planning started with the existing Yr 7 and 8 course which had been developed by the Head of Department and the whole department on a Graham Day using the non-Statutory Guidance matched existing course and defined new units. This gave the department a course covering all 17 Attainment Targets up to level 6, some level 7 and dabbling with level 8. This hybrid course has some bits which were good and some parts which were
The approach adopted was now regarded as a red herring as it set all the department on a particular course with an over-emphasis on Statements of Attainment and not the Programme of Study.

Scheme of Work in Practice.

Time was an important factor and the department were keen to get a course up and running. The course had many good ideas which were followed up but it also meant the department found on several occasions they were doing a U-turn. Judging the course against the end of Key Stage test results, it has not failed the department but as an educational tool it has shortcomings.

Assessment Strategies.

The department is philosophically aligned and committed to the Graded Assessment in Science Project (GASP) and it is integral to all the department's endeavours. The department would find it very difficult to work without GASP. GASP involves continuous assessment against specific criteria and pupils are involved in all parts of the assessment process. Feedback to pupils varies from teacher to teacher but all work is returned to pupils marked with a copy of the mark scheme attached and pupils are encouraged to discuss their work with their teachers and also to agree targets for the future. Content tests are also used which are marked by pupils and marking sampled by the teacher. Any answer which has been altered in anyway is marked incorrect unless the alteration has been authorised and signed by the teacher. Pupils have access to their records at all times and one teacher regularly prints out a target sheet for each pupil, for example a pupil may be required to work towards one exploration with X marks and 1 content test with X marks. All the work which pupils have done since they entered the school has been retained. The department therefore has plenty of evidence of pupil's achievements for all attainment targets which is used for agreement trialling. All pupils receive a written target specifying criteria for next GASP Level. The department is currently experimenting with National Curriculum level targets now that the revised orders are in operation.

Interpretation of Statements of Attainment.

The department frequently discusses interpretation of Statements of Attainments and they have had a few rows. Where doubts existed in practice the actual questions used on tests became the interpretation of the Statements of Attainments. The school had a certain amount of help with interpreting statements as they had been involved with the CATS (Consortium on Assessment and Testing) team on piloting BATS (bits of assessment tasks) in two
previous years. This gave a clearer idea of what some Statements of Attainment meant. In practice, they did not discuss all Statements of Attainment and in fact did not even attempt to dabble with some of the Statements of Attainment because of the imprecise use of language. Consistency was achieved by the department agreeing that whoever wrote the test items had responsibility for the interpretation of the statement. A training day had been used by the department to interpret the Statements of Attainment at AT10 from level 3 to about level 6-7. The department discussed each statement and considered what it meant in terms of expectation of pupils’ outcomes, they only managed to get half way through by lunch time. It did make the department more confident about the Attainment Targets. On the whole the department relied on professional judgement and experience and where judgements varied - they varied!

**Standardisation and Agreement Trialling**

Agreement Trials were held throughout the three years of the Key Stage as part of the GASP process. This was encouraged by the visits of the GASP Assessor. The department engaged in internal moderating prior to the assessor’s visit. This generated a great deal of discussion about pupils work and it meant that all the department were working to the same standards. The agreement trialling revolved around GASP levels and there was very little focus on National Curriculum levels. The department did take place in the National Curriculum Agreement Trials at the end of the Key Stage and the department was satisfied that they had a universality of standards for all ATs except Scl.

The department had been chosen for Quality Audit for Scl but following a long conversation with the Quality Auditor about the practicalities of sending work which was also being used for their GASP assessment they were withdrawn from the Quality Audit for Scl but, they had to eventually send off a 20% sample which had been re-assessed against National Curriculum Attainment Target levels for Sc2, 3 and 4.

Reaching agreement about Scl had been difficult despite all members of the department attending at least one of LEA Agreement Trialling Course. Some members of department were convinced that work was clearly at level 7 and others felt it was more like a level 3 because it did not show sufficient evidence of the intermediary levels. The school was heavily into explorations and practical work was superbly written up but it was still very difficult to ascribe a level given that pupils were taught and assessed against the old Attainment Targets and then records were required against new Attainment Targets. Pupils were very good at defining and planning explorations and they were very good at expanding on the problem or setting a problem in a context but they did find it difficult to
evaluate their investigations effectively. One colleague is concerned about the departments' interpretation of Sci - he may be right, so the department needs to discuss it further.

Decisions about appropriate entry to "tiers" for the end of Key Stage tests.

Using the GASP levels it was very easy to rank pupils in order of attainment, and enter all those with a GASP level 6/7 or above in the 5-8 tier, level 6-5/4 were entered for the 4-7 and everyone else for the 3-6 tier. The school did not open papers in advance but just prior to the test the Head of Department got cold feet and used all the available level 3-6 tier tests by pushing up the list of GASP rankings.

Those taking the tier of 5-8 gave rise to the majority of W. In the tier 3-6 there were two Ws and no Ws in tier 1-4 (10 pupils took this tier of test). With the subject aggregate no pupil got less than a level 3.

Monitoring of Pupils Progress and Recording Pupils Progress

Review of pupils progress is related to the GASP monitoring. A simple bar chart is produced each term showing the current GASP level for all pupils in the year group. This has been very illuminating when used as a long term study. It is very obvious if a class is making poor progress and it would be easy to attribute lack of progress to a poor teacher but a recent look at one particular group that appeared to be slowing in their rate of progress showed that the difficulty was due to the fact that the teacher was overloaded with other duties and did not have the necessary time for the administration of the scheme. Pupils were producing work at a high level but the teacher was unable to keep up with the thoroughness of marking required and so pupils' full achievement was not being recorded. When the evidence of the pupils work was checked by the Head of Department the pupils had made much greater progress than the administration suggested. GASP can enable work from several years to be salvaged and if the evidence is available the level of attainment can be awarded. The Head of Department had also taken over a group from a licensed teacher at the start of June and although their records showed only level 6 when the Head of Department looked at the evidence retained and marked it against the GASP criteria most pupils moved quickly from level 6 to level 12. The Head of Department was convinced that often pupils apparent lack of progress was due to complexities of administration rather than poor teaching or learning. The GASP Record Sheet is used to record pupils progress.
Relationships between Teacher Assessment and the outcomes of end of KS3 Voluntary Pilot.

By and large the results of the pilot test matched the teacher assessment. The average level achieved was level 5 and the school had been expecting about 5.5.

Use of supporting material provided by NCC and SEAC.

The plethora of material from the various agencies had been filed centrally and very little had been read. There was far too much paper and it was impossible to keep up with it. The Department is not even sure if they have a full set. They dip into documents from time to time. The department does a lot of reading about science education but it is not co-ordinated in any way.

Inset provided and its effectiveness

The INSET provided by the LEA had been inconsistent and somewhat bitty. Having said that talking to colleagues in other LEAs more was provided than in other areas. Overall, the training was considered to be about as good as could be expected given the many changes and uncertainties. Greater co-operation and collaboration between schools would have been welcomed particularly in planning SC1 activities.

Experience of GCSE and coursework assessment

The school had just prepared its first cohort for GCSE and found the experience of coursework moderation at GCSE very useful for KS3.

Issues arising from case study

A department working under the leadership of a relatively inexperienced Head of Department and with almost no experienced staff and a high turnover.

- The department did use the transfer documents and linked them to GASP record sheets. The Head of Department was very diligent in analysing work pupils brought from primary schools to give a GASP level. This diligence must be set against a background of frustration because of the difficulties of inconsistencies and differences in format of records from so many feeder primary schools.
The school worked hard to promote continuity Key Stage 2 - Key Stage 3 but were concerned that liaison was in one direction only. The Department worked collaboratively but with over emphasis of Statements of Attainment in the Schemes of work rather than the Programmes of Study.

Built on existing Schemes of Work - evolution based on good practice.

The pace of implementation caused difficulties, in that the department was anxious to get a course up and running - but also meant several U-turns.

The Scheme of Work meant that the department felt that by the end of the Key Stage they had, in terms of test results, delivered the goods but they found it had not been particularly captivating to teach and had not always seemed to promote the sort of learning in science the department wished to promote.

The previous involvement and commitment to the Graded Assessment Scheme meant the department felt it was in a strong position with regard to assessment.

The use of the GASP scheme ensured that pupils were involved in the assessment process.

The department was uncertain and thus anxious, about how much evidence of pupils' work they would need to retain so they kept it all. This gave rise to issues about storage and retrieval and also considerations of the effect on pupils learning by separating pupils from their work.

The department did give pupils a written target. Assessment was therefore used to feed-forward to pupils future learning.

The department did have a collaborative and collegial approach and they resolved issues and difficulties in a very pragmatic manner.

The involvement of the department with the CATS team developing an approach to Sc1, meant that they had an opportunity to develop their thinking about interpretation of Statements of Attainment and also to understand the purpose and benefit of agreement trialling. The GASP project involvement further honed their skills of reaching agreement about the standards attained by pupils.
• This conscientious department seemed to be effected more than some other departments by the re-structuring of the National Curriculum during the key stage.

• Monitoring of pupils’ progress revealed that often pupils apparent lack of progress was due to the administration of the assessment scheme rather than poor teaching or learning. An effective assessment scheme needs to be manageable by everyone in the department.

• The inconsistency and bitty nature of Inset provision could be due more to the change to LMS where senior managers decided who they would pay teacher release for in order to take part in teacher development. This meant that schools tried to allow all members of the department a chance to take part in some aspects of the training, so there was very little continuity in the training. The pace and demands of work meant that there was almost no opportunity for individual teachers to share their part of the training process with others.

• Like School B, School C would have welcomed greater co-operation and collaboration between schools in planning Sci activities.
CASE STUDY 3

School D

All members of the Department were involved in teaching pupils National Curriculum Science and all were involved in the end of Key Stage 3 Voluntary Pilot. The Head of Department was the only person with a responsibility allowance, so there was no KS3 Coordinator or Year Co-ordinators. The school has been experimenting with GASP since the introduction of the National Curriculum.

Building on previous experience - Use of Transfer Documents.

Currently the department made no use of the LEA transfer documents as they were impossible to use. Primary schools perceptions of pupils achievements were "pie in the sky". Most pupils had been assigned a minimum of a level 4 by their primary teachers and this certainly did not match with attainment displayed during Year 7 at Secondary school. If the school had confidence in the levels recorded then they would use them. As yet the department has not had any discussion about the most appropriate strategies for building on pupils previous science education. Liaison with primary schools is very weak at the moment and the department acknowledges that they are unsure about precisely what the pupils will have already experienced and how to ensure appropriate progression.

Planning Schemes of Work for Key Stage 3.

Prior to the introduction of the National Curriculum the department had strong reservations about the suitability of their current Scheme of Work so they decided to start again from scratch. They undertook an analysis of all the appropriate published schemes available at the time and decided that the Active Science most closely matched with the demands of the National Curriculum. The chapter headings were used as Topics and then they used these to write the Schemes of Work. The department had been allocated INSET time for this purpose. The publishers of Active Science had made claims that the course was suitable for full coverage of the National Curriculum at Key Stage 3 and at the time they took the publishers word for these claims.

Scheme of Work in Practice.

The scheme in practice showed that the publishers had been extremely optimistic in their claims and they increasingly used other materials as they became more aware of the demands of the National Curriculum and to ensure full coverage of some of the Statements.
of Attainment. Reviewing the Key Stage the department still has strong reservations about the Scheme of Work and feels that it needs to be rewritten yet again, and in fact their previous Yr 9 course would have probably prepared pupils better for the end of the Key Stage Assessment. In the light of the revision of the science orders the revised Schemes of Work will place a much greater emphasis on the strands and these were welcomed as it was felt that they would promote a more challenging and paced progression for pupils.

Assessment Strategies.

At the same time as introducing the National Curriculum the department embarked on the Graded Assessment Science Scheme (GASP) and so the assessment strategies were based around GASP explorations and end of unit tests. The test focussed on two or three Statements of Attainment from the old attainment targets and the work was taught in units over a period of 4 weeks. The tests had been written with different degrees of difficulty. As a result the Teacher Assessment had been done in an "amazingly arbitrary way" based solely on the Statements of Attainment the tests had addressed. In the departments opinion Scl for year 9 pupils had been done badly, the GASP explorations criteria were unfamiliar and at odds with National Curriculum demands and they fell by the wayside. To a certain degree the teachers lost their way and had taken too much on board with National Curriculum and GASP. The department then tried to set up a number of explorations to meet the new demands of the revised Scl. The tasks chosen did not meet the demands of all three strands. The emphasis with the GASP explorations is on planning with no emphasis on predicting. The department will continue with GASP exploration for the current Yr 7 and Yr 8 with National Curriculum modifications as the teachers are becoming more confident and more familiar with the demands of both.

Pupils were given feedback immediately on the results of their tests although the feedback did not link directly to National Curriculum levels. Currently pupils are not informed about the Statements of Attainment they are addressing and so they have no idea about what level they are at. The department is committed to altering this from September and will aim to teach the strands progressively. GASP has designed a new record card linking GASP levels directly to National Curriculum levels and software is being produced which should aid the recording process. The department also intends to provide parents with an indication of pupil progress on a termly basis and to suggest targets for pupils. The department feels that currently, parents know very little about what their daughters are doing in science. The department also feels it is now important to find a suitable textbook for pupils to retain for use at home and this is a priority in terms of resources.
Interpretation of Statements of Attainment.

For Scl all the department sat down with pieces of pupils work and moderated. Despite the departments moderation experience at GCSE the moderation was not done very well, in the opinion of the Head of Science, who is a Chief Examiner for GCSE. For the interpretation of other attainment targets they relied on publishers’ claims.

Standardisation and Agreement Trialling.

The department undertook some Agreement Trials after the department had been involved in the Agreement Trial Training provided by the LEA. This was very hurried and showed the department the need to do much more Agreement Trialling if they are to ensure consistency of standards and expectations. It was evident from the agreement trialling that people do not apply the same standards. The visits of the GASP Assessor may also help teachers to come to consensus about standards.

Decisions about appropriate entry to "tiers" for the end of Key Stage Tests

The decisions about which tiers of tests to enter pupils for was based on the setting of classes. The two top bands were all entered for the 5-8 tier (60 pupils) and the remaining sixty pupils in the lower band were entered for the 3-6 tier. The papers were opened in advance to make appropriate arrangements for statemented pupils and the Head of Department decided to alter the original plans and entered the top 40 pupils in the Year 8 examinations for tier 5-8 and all the remaining pupils in the 3-6 tier. In the 5-8 tier several pupils received a W but only 1 pupil from the 3-6 tier received a W.

Monitoring Pupils Progress and Recording Pupils Progress.

The GASP results are analysed and used as the basis for monitoring pupils progress and pupils progress is recorded using the GASP Record Sheets.

Relationships between Teacher Assessment and the outcomes of the end of Key Stage 3 Voluntary Pilot.

There was at least one level disparity between the end of keystage level and the teacher assessment. The teacher assessment being higher. The Head of Department thought that the teacher assessment was blunt and not very accurate but felt neither assessment reflected where pupils were. The end of keystage tests produced lower scores then pupils ability.
Use of Supporting Material provided by NCC and SEAC.

The school assessment folder was received late but it was used on a school development day. It was very valuable but it was needed earlier, as a result the impact of the INSET had not been as great as it could have been. The department would welcome more guidance on how to sort out the assessment.

INSET provided and its effectiveness.

The 3 day conference organised by the LEA as an introduction to the National Curriculum had been very valuable. It was pragmatic and was welcomed as a driving force. Within the school the Headteacher is very concerned to keep demands on staff reasonable and most INSET tends to address Whole School Issues. The department feel they need some extended INSET for all members of the department.

Experience of GCSE and coursework assessments

The department had found experience of GCSE useful in approaching agreement trialling - but they did not do enough.

Issues arising from case study

- commercial schemes - how to analyse and compare publishers claims?

- Teacher assessment potential needs to be realised and exploited fully if pupils are to make appropriate progress.

- How to provide sustained Inset for all members of department.

- Timing and relevance of Inset.

- Co-operation and collaboration with developing explorations for SC1.

- What do teachers base professional judgement on?

- Transfer document were not used because of lack of trust in judgement of primary colleagues about level of pupils attainment. Department had not decided how best to build on pupils previous experience.
• New schemes of work based on a published scheme. The department had been released to work together on the development of the scheme of work. Trusted publishers claim.

• Published schemes can have considerable influence on the work of departments. In this school’s case, experience showed that the claims of the publisher were not fully met in reality, so what had originally been viewed as a good support and a time saver led to several revisions of the scheme with consequences for teacher time, teacher confidence and also pupils’ progression.

• The department was somewhat over ambitious in taking on the implementation of the National Curriculum, a new publisher’s scheme and the GASP project at the same time.

• In coping with so many changes at once the department had to do a lot of back tracking and this had an effect on teacher confidence.

• Teacher assessment relied almost wholly on end of unit tests and the department was aware that these tests only addressed some statements of attainment.

• Pupils did receive feedback on their attainment but they were not involved in shaping their future learning by sharing the criteria by which learning would be assessed with their teachers.

• The very limited use of agreement trialling showed the department the need to develop their skills in interpreting and agreeing on the interpretation of the statements of attainment and also the need to do more agreement trialling to ensure consistency of standards and expectations.

• There does seem to be some tension about assessment, either through on-going teacher assessment or end of key stage tests as in the opinion of the Head of Department neither truly reflected the pupils’ ability.

• In this school, there were also tensions between the Senior Management priorities for Inset and the department’s view of their needs.
CASE STUDY 4

School E

All teachers in the department teach the National Curriculum at Key Stage 3 and all were involved with Yr 9 pupils in the academic year 1991/92. The school has a Key Stage 3 Co-ordinator.

Use of Transfer Documents

The school did not use the transfer documents provided by feeder primary school giving details of pupils current achievement in science because the department considered them to be useless. The information was so variable and pupils covered different topics in each school. There was also mistrust of the levels given by primary teachers. Instead, the school has an introductory course which lasts 6 lessons. Pupils starting points are identified and pupils with special needs are also identified. The groups are staffed with 4 teachers to 3 tutor groups for this introductory course and the additional teacher moves between teaching groups identifying pupils with special educational needs. After the introductory course pupils are re-grouped into sets within broad ability bands. Eight sets are established with the two lowest sets smallest in size.

Planning Schemes of Work for Key Stage 3

The Oxford Science Programme is used as the basis of the scheme of work. Individual teachers were allocated particular topics and required to write the scheme of work and indicate additional material and worksheets as deemed necessary to cover the ability range and the demands of the National Curriculum. The schemes of work were organised into 14 topics and teacher packs were produced and these were issued to every teacher.

The department had produced suggested routes through the schemes as it is not possible for all pupils to follow the same topics at the same time.

Schemes of work in practice

During the first run through of Key Stage 3 the department did not have sufficient textbooks to provide each child with their own so pupils only had access to the text books during lesson time. The suggested routes mean that by the end of each term
each set had covered roughly similar work so that changes can be made to the sets if necessary at the end of each term. In the light of the experience of the first run, through the department in re-writing the scheme because although the publisher claimed full coverage of the National Curriculum for Key Stage 3 the department has found several "holes" in the scheme. Teachers are writing their own worksheets to augment those in the publisher's scheme. The interpretation of the programme of study and attainment targets is taken as the interpretation given by the publishers.

Assessment Strategies

Assessment was almost exclusively by end of unit test which were drawn from the GASP Statement back and from marking of pupils written work, which was not marked by attainment targets but in the school's conventional agreed manner which was based on two marks out of 10, one for presentation and one for content of work. The department had also drawn on the GASP Investigation Book for Sc. All pupils did one full blown investigation per module. Pupils took approximately 12 tests per year in Yr 7 and 8 and 15 tests in Yr 9.

Interpretation of Statements of Attainment

The department relied almost exclusively on the interpretation of statements of attainment displayed by the publisher's material. The department had not thought it necessary to agree a common interpretation as they had complete faith in the publishers interpretation.

Standardisation and Agreement Trialling

The department had not held any agreement trials for moderating pupils' work nor had they thought it necessary to discuss and standardise individual teacher's assessment, relying solely on the professional judgement of each teacher.

Decision about appropriate entry to Tier at end of Key Stage Assessment

The department had geared its own end of unit tests at levels 3-6 and the test results and professional judgement were used to decide on entry for each pupil, with decisions being made for entire sets.
The department opened the test papers in advance to make appropriate arrangements for pupils with special educational needs or with English as a second language. The department did not make any last minute decisions about tiers when the tests were viewed and they stuck to their original decisions. In retrospect, the department feels only one child had been possibly mis-entered in the appropriate tier.

The department used the exemplar material produced by SEAC for a 'mock' SAT to finalise decisions about entry for tiers.

**Monitoring pupil progress and recording pupils progress**

Currently very little monitoring of the department's work takes place either by the Head of Department or by the Senior Management team of the school. Pupil progress is not recorded against attainment targets but against GASP Levels. Feedback is given by day by day marking and the results of end of unit tests "monitoring of the departments work is not a big feature". Individual teachers use their own records to plan for differentiation within their teaching group.

The school sends one full report to parents each year and in addition sends termly reports for every subject on a basis of good, satisfactory, unsatisfactory. (G,S,U) the good and the unsatisfactory grades must be accompanied by a teacher comment. In addition, after the school internal examinations parents receive a computerised results printout with a form tutor comment and a pastoral comment.

**Relationships between Teacher Assessment and the outcomes of the end of Key Stage 3 Voluntary Pilot.**

All pupils attained a higher level in the end of Key Stage 3 tests than they had done on the basis of teacher assessment. Prior to the tests the department had requested a full day release from timetable for science for Year 9 pupils and it was used as a "science cram day". The "pupil speak" attainment targets statements produced by an advisory teacher in Tower Hamlets had been used for the science cram day. Copies of these attainment targets were sent home and parents were encouraged to help their children revise using these statements. Towards the middle of the year additional funding was secured and a textbook was purchased for each pupil. All pupils now have a textbook to use in lessons and at home.
Use of supporting material provided by SEAC and NCC.

Very little use had been made of the guidance produced by SEAC or NCC.

INSET provided and its effectiveness

Much of the INSET provided by the LEA had been useful but it was also variable in quality. The INSET which bought groups of teachers together to plan units of work was useless as the needs of each school, and the approaches employed were so different. The department would welcome help with Scl activities, particularly at the higher levels. The INSET for the end of Key Stage tests was appropriate, once all the moaning and groaning had been filtered out.

Experience GCSE and Coursework Assessment

The department felt that the experience of GCSE and the demands made by the Examination Boards on coursework marking had helped the department cope with the demands of science at Key Stage 3. The department would welcome much more guidance on planning and assessing Scl as they feel the National Curriculum is just starting to bed down. The department did express concern about the preparation of pupils for Key Stage 4 when things like balancing equations had not been covered at Key Stage 3.

Issues arising from case study

- Interpretation of statements of attainment is based solely on publisher’s judgement.

- Very little formative assessment takes place so there is little opportunity either to provide pupils with appropriate feedback and thus to set targets or for teachers to plan on the basis of assessment information gathered - the lack of formative assessment also means that teachers are unclear about pupils attainment and so could be in danger of providing inappropriately and not providing pupils with sufficient challenge at an appropriate pace, which may account for the disparity between teacher assessment and end of key stage test results.

- Inexperienced teachers had to write schemes of work for others and also decide how to differentiate work for pupils of different abilities.
• Support and guidance for planning appropriate investigation for Sc1 is needed.

• School able to rely on parental support to encourage pupils to revise.
CASE STUDY 5

School F

The majority of teachers in the department teach the National Curriculum at Key Stage 3 and all but one was involved with year 9 pupils in the academic year 1991/92. The department has an assessment co-ordinator for Key Stage 3 on an 'A' allowance.

Use of Transfer Documents

The department did not make any use of the transfer documents provided by the feeder primary schools. They did not use them because they felt they are coping with several conflicting pressures at the moment and if they did use them they would need to change their practice and re-write their schemes of work in order to stretch pupils further. They feel they may even need to have several schemes of work to provide appropriately for all pupils. Observations of pupils show that whilst pupils may arrive with considerable knowledge it takes pupils some time to become familiar with the labs and to display the skills they are said to have acquired. On the whole, despite the emphasis at primary schools on developing independence, pupils seem unable to organise themselves.

Planning Schemes of Work for Key Stage 3

The department split the work evenly between members of the department. Statements of Attainments from the 17 attainment targets were cut up and each individual was given some of the statements of attainments as the basis of their planning, they were required to slot these statements into the topics the department was already using. The teachers did not use the programme of study for this planning, it was solely based on statements of attainment.

Schemes of Work in Practice

Staff tended to employ their own style, with common worksheets interpreted differently. Each module was written by a different member of staff and it was difficult to promote consistency - there was a lack of ownership of the planned work and teachers tended to modify the scheme according to their own values and beliefs.

The department does have strong reservations about their schemes of work as they feel it does not meet the needs of all pupils. The school's Special Needs Co-ordinator is encouraging and pressurising the department to address the revision of the schemes of work, but the staff feel that too many other developments are taking their time. One
member of the department is a member of the Senior Management Team and all the others have considerable pastoral responsibilities etc.

The schemes of work do not specify ways of working and there is very little agreed understanding of statements of attainment interpretation. The department feels that they could monitor coverage by individual teachers of the scheme of work but feel that this would result in less freedom and professional judgement would be threatened and undermined.

Assessment Strategies

Assessment is largely by means of end of unit tests. The department has produced guideline sheets for each unit and these are used erratically, depending on each teacher deciding when it is appropriate, convenient or good for the class. The department has no method to ensure the programme of study is achieved. The department felt that the revised statements of attainment are diverse and complex. It was much easier with the old attainment targets to set questions for the end of unit tests, but with the broadness of the statements of attainment now they have got a problem. Some members of the department are trying to encourage pupils self-assessment but this is proving somewhat unwieldy and may fall into disuse, because of the time it takes to teach pupils how to use the self assessment sheets. Marking books is also used as an assessment strategy.

Interpretation of Statements of Attainment

There is considerable diversity about the interpretation of statements of attainment due to the distribution of statements of attainment and the delegation and distribution of the preparation of schemes of work. There is no common complete agreement. There is understood to be a shared professional judgement and shared values, but this is not necessarily the reality. The writer of the schemes of work interprets the statement of attainment. The Head of Department monitors the preparation and production of the scheme of work but does not share with the department his views on the interpretations made. It seem to the department that almost as soon as the scheme of work is written it needs to be re-written because there is such divergence in interpretation and also because there is no coverage of the programme of study. The school is in a difficult position and is unable to photocopy worksheets because of financial constraints due to an overspend which had occurred because of prolonged staff illness. The department regards its lack of common goals and common values as it biggest problem. This lack of common values is largely due to variation in experience and the confidence of different members of the department.
Standardisation and Agreement Trials

The department engaged in some moderation of Scl prior to the end of Key Stage 3 Assessment.

Decision about appropriate entry to tier of end of Key Stage 3 Assessment.

Every pupil in Year 9 was given a test which covered Scl 2, 3 and 4 and pupils were also required to do a planning of an investigation this was done on lined paper and retained for the Quality Audit. The results of the tests set were used as the basis of decisions about the appropriate tier for each pupil. The department did not make any last minute changes when tests were opened early because pupils had already been informed which test they would be taking. For the majority of pupils, the department got the decision about the tiers about right. Some apparently lower ability pupils did better than expected because the department feels they were advantaged by the support given to them.

Monitoring pupil progress and recording progress

Every subject is required to fill in a summative record for the pupils’ Record of Achievement and to aid pupils in their development of their personal statement. They have been revised recently to meet the requirements of the National Curriculum. The focus of this information is the form tutor who is allocated one hour a week to conduct interviews with members of their tutor group. The form tutor can and does feedback from these interviews into the system either at subject teacher level or Head of Department level. This is a formal process and is co-ordinated by the director of Assessment and Profiling. There is no other monitoring of pupil progress.

Relationships between Teacher Assessment and the Outcomes of end of Key Stage Tests

On the whole the teacher assessment correlated reasonably with the end of Key Stage tests. The lower ability pupils tended to surprise teachers as they did better in some respects.

Use of Supporting Material provided by NCC and SEAC

Assessment folder - the guidance given for Scl was used by staff and pupils and it contained some good assessment suggestions. The department read all guidance material produced and used a lot of it. Some of the sample tests were used during lessons. The
department is already using the tests from the 1992 pilot in some classes and for some of the topic tests.

**INSET provided and its effectiveness**

The department has not found the INSET provided by the LEA useful. They do not like staff sharing their ignorance with other staff. They are very selective about any INSET they use.

The department had originally been a GASP school but had abandoned GASP when they tried to manage the schools demands for profiling, the requirements of the National Curriculum and GASP. They do not regret abandoning it but questions were asked by the LEA. The department had been reluctant initially to follow GASP but the LEA had offered a 'B' allowance and so they took it up. The postholder however was not wholly committed to GASP.

**Experience of GCSE and Coursework Assessment**

The examining boards support of assessment and recording at Key Stage 4 has been of excellent quality and has been extremely useful to staff. The board demands assessment and moderated material, so the department's practice is much better at Key Stage 4 than it is at Key Stage 3. The external demand of the examination board has been a "useful coercer" for the department.

**Issues arising from case study**

- Transfer documents were not used because the department knew that it would give rise to several issues that they could not address at that time.

- There was a recognition that pupils may regress in coming to terms with the more formal laboratory approach to science cultures of primary and secondary schools.

- Teachers were disappointed that the pupils were less independent than they hoped. (This is probably because the organisational demands made upon pupils in Y7 are totally different from the demands made upon them in primary school.)

- The department slotted statements of attainment into existing schemes.
• Planning was left almost exclusively to individuals working separately, giving rise to divergence in approach which seems to arise from a lack of understanding that the curriculum was intended to be an entitlement for pupils.

• Time and energy was spent producing guideline sheets for units of work but then the department used them erratically. The department recognised the need to involve pupils in assessment but concerned about the time it takes to train pupils in using marking schemes etc.

• There does seem to have been a lot of back tracking and U-turns which could be a reflection of inexperienced management of the department. It certainly does have an affect on teacher morale.

• Local Management of Schools (LMS) did seem to be having a deleterious effect on curricular provision.

• Much of the approach and style of this department was reactive to the latest demands from SEAC and does not reflect a managed approach to change.

• Tests showed that lower achieving pupils did better than teachers expected.

• The uptake and subsequent abandonment of the GASP scheme does give rise to concerns about the overall commitment of this department to promoting effective learning.

• The department seems to wait until is is coerced into action.
CASE STUDY 6

School G

All teachers have been involved in teaching the National Curriculum at Key stage 3 and all were involved with Yr 9 pupils in the academic year 1991/92. The department has a co-ordinator for each of the year groups for Key Stage 3.

Use of Transfer Documents

The school is part of a liaison group which pioneered the use of transfer documents. The liaison group consists of the main feeder primary schools and the four main secondary schools to which they feed. The department has been using transfer documents since the implementation of the National Curriculum and has endeavoured to plan schemes of work which are appropriately differentiated to provide a suitable curriculum for pupils in the school. The transfer documents have been used more recently to look at the starting points of pupils and then to determine the maximum finishing point as pupils leave Key Stage 3. The department then plans its schemes of work to accommodate the different range of pupils attainment and needs.

Planning Schemes of work for Key Stage 3.

The schemes of work used by the department are largely based on the Nuffield Science National Curriculum Course for Years 7, 8, and 9. The department used the flow diagram in the Non-Statutory Guidance for science and matched the commercial scheme against the demands of the National Curriculum. The department meets weekly and all members of the department discuss each topic as it is planned. Discussion covers such things as interpretation of attainments, appropriate teaching and learning and programmes of study, investigations, assessment of learning outcomes, criteria for assessment and support needed for different groups of learners. The Head of Department then incorporates all points covered in the discussion in the scheme. The science teacher with additional non-content time for special needs support then prepares help sheets, extension sheets and any other support material needed for the topic. All pupils in each year group follow the same topics at the same time with slight variations between lessons to ensure adequate provision of equipment and resources.
Schemes of Work in Practice.

As all members of the department have been involved in the decisions about the structure content and assessment of each topic all members of the department use the scheme of work as a working document. Where difficulties are encountered with any aspect of the scheme of work by individual teachers they draw the attention of the Heads of Department to these difficulties on their weekly record of work sheets. All topics are reviewed annually and information is extracted from the record of work sheets to inform the review process. The support and differentiated material provided by the Science teacher with responsibility for support for special educational needs is valued and found to be extremely helpful to pupils and reduces stress for teachers for each topic as is the scheme of work. Pupil guidelines are produced and these are given to pupils who use them to ensure that they have done all that is required in a particular topic and they are also used by pupils to ensure that the teacher covers everything required. The Year 7, 8 and 9 co-ordinators ensure that the technicians are informed about the work to be covered and also ensures distribution of supporting materials and assessment sheets.

Assessment Strategies

The department uses the work generated in a particular topic for assessment purposes so within a particular unit pupils may be assessed on a talk or presentation, a planning exercise, or the written report of an investigation, amongst other items. The department agrees on the assessment criteria in advance by discussing and agreeing on the interpretation of the Statement of Attainment. The content is also shared with pupils and they may be involved in self assessment or peer assessment. Some end of unit tests are used to check some aspects of attainment targets but end of unit tests are not the predominant mode of assessment. The department makes as much use of ephemeral evidence and tangible evidence and assessment information is used both for day to day planning of appropriate work and also for regrouping children regularly so that they are taught in sets, but in sets which are changed regularly and the sets composition is determined by discussion of pupils work and agreement on the evidence retained. The year co-ordinator distributes record sheets at the start of each topic and collects them at the end. Topics are planned in pairs and so one topic is introductory and the second topic extends pupils skills according to their attainment and skills displayed in the first topic. The revision of the science orders has meant that the department is reviewing constantly their exploration and investigations for Scl.
Interpretations of Statements of Attainment

The department meets weekly for one hour and has instituted a rolling programme for collectively planning schemes of work, this ensures a common interpretation of the statements of attainment. The school was also a pilot school for the development of end of Key Stage 3 tests with the CATS and so have spent some time with other teachers amplifying and unravelling statements of attainment.

Standardisation and Agreement Trialling

The department holds regular agreement trials and all movement between sets is conducted on the basis of looking at pupils work and discussing and agreeing the attainment level it represents. The department plans all schemes of work together so aiding the standardisation process and all teachers assess against discussed and agreed criteria.

Decisions about appropriate entry to tier of end of Key Stage Assessment

This was decided on the basis of Teacher Assessment records which had been maintained throughout the Key Stage. The papers were opened early to make appropriate arrangements for pupils with special educational needs or English as a second language but the department did not make any last minute changes for any pupil to take a different tier test once the papers had been sighted.

Monitoring Pupil Progress and Recording Pupil Progress

Every pupil has a progress record in the inside cover of their exercise book. Teacher enter grades and also provides feedback and feed-forward to pupils and suggestions are made so that each pupil can improve their work. The science year co-ordinator monitors each pupil's progress unit by unit and rearranges the sets regularly. The Head of Department visits lessons regularly to monitor progress. The class teacher has a record sheet of each unit which gives details of learning activities, their assessment and the attainment target and level. These are used as formative records and they are summated approximately twice a year to give information for the summative record. Pupils receive a full report annually which identifies strengths and weaknesses and sets targets for the pupils. The department conducts reviews of all pupils progress twice a year.
Relationships between Teacher Assessment and the Outcomes of the end of Key Stage 3 Voluntary Pilot

There was a fairly close match between Teacher Assessment and the end of Key Stage 3 results, a small number of pupils entered for the 5-8 band had fallen down on one attainment target and had been awarded a W but on the whole the teacher assessment and end of Key Stage 3 test results were usually the same.

Use of supporting material provided by NCC and SEAC

The department had used the Non-Statutory Guidance as the basis of their planning and they also found the NCC booklet on investigations very useful. They had read all documents produced by SEAC and had found Teacher Assessment in Practice and the science exemplification Pupils Work Assessed - Science KS3 material particularly useful. The department welcomed of the idea of NCC producing distance learning materials such as the Forces Book for Key Stage 2 but felt that the material was not appropriate to the needs of the teacher with its emphasis solely on subject knowledge and not on teaching methodology.

INSET provided and its effectiveness

The department had taken part in INSET provided by the LEA, the Institute and by Kings College and also by the publishers of the scheme used and found almost all of it useful to varying degrees.

Experience of GCSE and Coursework Assessment

The teachers felt that the experience of GCSE had been very useful particularly the requirement to moderate across subject specialist and also across teaching groups and had built on this experience at Key Stage 3.

Issues arising from case study.

- The department had been involved in developmental work with other schools looking at how to build on pupils earlier learning experience and this meant that they were able to evolve this approach when implementing the National Curriculum.
• The approach to developing Schemes of Work reflected the Head of Department’s commitment to collaborative, collegial endeavour with a well-managed approach.

• The additional time provided for Special Needs Support was effectively used.

• The curriculum was designed with approaches to differentiation and assessment strategies incorporated at the planning stage so that teachers coped with the demands with the minimum of stress.

• Again, the involvement of the department in developmental work with the CAT’s team meant that they had time and opportunity to develop their professional judgement, whilst unravelling statements of attainment with teachers from other schools.
Summary

The six cases of schools situated within one LEA indicate that the way in which schools understood what they needed to do to implement the National Curriculum varied tremendously. The diversity of approaches taken meant that pupils received a considerable variation in provision. Many factors influenced how each department went about the implementation of the National Curriculum in Science and these will be discussed more fully in Chapter 7, based on the evidence of these six schools. The question must be asked "what National Curriculum?"

Many of the difficulties encountered by the case study schools were also identified as problems nationally.

"There were worthwhile attempts to develop curricular liaison with preceding schools, but such initiatives were usually at an early stage of development and the introduction of the National Curriculum has highlighted the need for improved curricular continuity between and within schools. This is a long standing problem for secondary schools, to ensure that they build on the pupils’ previous scientific experience."

(DES 1991. p.16)

In Science Key Stage 1 and 3: A report by HM Inspectorate on the first year 1989 - 90 HMI observed.

"The National Curriculum established entitlement to the content of science for all pupils from the ages of 5 to 16. The benefits which accrue from a continuous science education with a range of attainment targets will depend on the co-ordinated planning of courses which take full account of pupils attainment. They will also depend on a well thought through progression in teaching and learning methods. It is vital that the advantages of an early start in science education are not lost, or experiences gained in primary schools repeated unhelpfully."

(DES 1991. p.24)
In "Teaching Science at Key Stage 3 and 4 published by the NCC 1993, reiterates importance of consistency.

"Unless members of a department have a common understanding of the aims of science education and the objectives for a particular unit of work, the pupils are likely to perceive the programmes as incoherent."

(NCC 1993)

HMI also noted in their report "Science Key Stage 1 and 3: A Report by HMI Inspectorate on the first year 1989-90, they observed.

"Most schools revised their teaching guidelines. However, little attention was given to the Programmes of Study and the non-Statutory Guidance from the National Curriculum Council and many schools used a combination of school based materials and commercial schemes as teaching guidelines."

(DES 1991. p.16)

A minority persevered with dated materials.

Nationally, in terms of assessment HMI observed

"The standard of learning was invariably high when assessment practice was itself of a good standard." and assessment and learning were inextricably linked.

(DES 1991. p.9)
<table>
<thead>
<tr>
<th>Case Study</th>
<th>Documents used √ or not used X</th>
<th>Comments</th>
<th>Basis for ascertaining starting points</th>
<th>Grouping of pupils</th>
<th>Basis for allocation to groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X</td>
<td>Unmanageable</td>
<td>Assumed pupils had done little science and started from scratch.</td>
<td>Yes setted.</td>
<td>LEA Maths + reading scores.</td>
</tr>
<tr>
<td>2</td>
<td>√</td>
<td>Tried to use varying degrees of diligence.</td>
<td>Combination of transfer document. GASP PR3 sheets and evidence gleaned from samples of pupils work.</td>
<td>Mixed ability.</td>
<td>Random.</td>
</tr>
<tr>
<td>3</td>
<td>X</td>
<td>Impossible to use.</td>
<td>No discussion yet. Liaison weak. Dept unsure about precisely what pupils will already have experienced and how to ensure appropriate progression.</td>
<td>Mixed ability.</td>
<td>Random.</td>
</tr>
<tr>
<td>4</td>
<td>X</td>
<td>Useless, information variable and different coverage of topics. Mistrust of levels.</td>
<td>Introductory 6 lesson course.</td>
<td>Sets within broad ability bands.</td>
<td>Assessment during introductory course.</td>
</tr>
<tr>
<td>5</td>
<td>X</td>
<td>If they did use them would cause them to reappraise practice. Unable to contemplate this at the moment.</td>
<td>Assumed very little experience. Disruption of transfer caused regression.</td>
<td>Mixed ability.</td>
<td>Randomly.</td>
</tr>
<tr>
<td>6</td>
<td>√</td>
<td>Part of a liaison group which pioneered the use of transfer documents.</td>
<td>Transfer documents.</td>
<td>Flexible sets.</td>
<td>Linked units of work - pupils re-grouped end of each unit.</td>
</tr>
<tr>
<td>Case Study</td>
<td>Use of commercial scheme</td>
<td>How was it planned and drawn up</td>
<td>Cross-curricular Issues</td>
<td>Comments</td>
<td></td>
</tr>
<tr>
<td>------------</td>
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<td></td>
</tr>
<tr>
<td>1 Modified existing scheme. Using process science flow chart in NSG. Based on ATs rather than PoS.</td>
<td>Yes. Warwick</td>
<td>Analysis using matrix, discussion largely developed by KS3 co-ordinator.</td>
<td>Identified by matrix initially. Good liaison then with other depts.</td>
<td>Increased content, less emphasis on process.</td>
<td></td>
</tr>
<tr>
<td>2 Modified existing scheme using NSG. Developed a course covering all 17 ATs</td>
<td>No</td>
<td>Dept working and discussing together.</td>
<td>No specific reference.</td>
<td>Over emphasis on ATs at expense of PoS.</td>
<td></td>
</tr>
<tr>
<td>3 Started from scratch analysed all new schemes published.</td>
<td>Yes. Active Science.</td>
<td>Individual teachers allocated particular topics required to write up.</td>
<td>No specific reference.</td>
<td>Allocated inset time for purpose. Started from ATs rather than PoS.</td>
<td></td>
</tr>
<tr>
<td>4 New scheme Oxford Science Programme.</td>
<td>No</td>
<td>Individual teachers were allocated topics suggested-routes through scheme.</td>
<td>No particular reference.</td>
<td>Additional material and worksheets produced by individual teachers.</td>
<td></td>
</tr>
<tr>
<td>5 Developed existing scheme.</td>
<td>No</td>
<td>Split evenly between members of dept.</td>
<td>No particular reference.</td>
<td>Used only SoAs.</td>
<td></td>
</tr>
<tr>
<td>6 Used NSG flow chart to check match against current scheme</td>
<td>Nuffield Science NC Course for Yr 7,8 and 9.</td>
<td>Planned collaboratively by all members of Dept. Written initially by HoD to an agreed dept format, then after full discussion units written up by individuals.</td>
<td>No particular reference.</td>
<td>Rolling programme. Discussion covers interpretation of SoAs. Appropriate T + L activities. Investigations. Assessment of learning outcomes. Criteria for assessment + support for pupils with Special Needs.</td>
<td></td>
</tr>
<tr>
<td>Case Study</td>
<td>Issues</td>
<td>Comments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 1          | • Used on automatic pilot initially.  
• Worksheets and guidance to dip into.  
• Very brief lesson outlines. | | Opportunities for inconsistencies.  
Refers to ATs but does not give details of specific SoAs being addressed nor does it give detail of the desired learning outcomes, or any information about assessment procedures left to the discretion of individual teachers. |
| 2          | • Pushed for time.  
• Several U-turns required.  
• Judged against outcomes of KS3 tests it did not fail dept. but as an educational tool it had its shortcomings. | Danger of teaching to the tests.  
Lacked relevance, pupils not as motivated as dept would wish. |
| 3          | • Publishers extremely optimistic in claims.  
• Supplemented by other materials.  
• Strong reservation about SoW feel needs to be re-written again. | Previous Yr9 course would have prepared pupils better for end of KS tests.  
The revised SoW will put much greater emphasis on strands. |
| 4          | • Access to textbooks by pupils only during lesson time initially.  
• Publishers claims of coverages not met.  
• Many holes had to be plugged.  
• Interpretation of PoS and SoAs are taken as publisher’s. | Suggested route means that by the end of each term each set had covered roughly similar work so that changes can be made to the sets if necessary.  
Re-writing scheme. |
| 5          | • Staff tended to employ their own style.  
• Each module written by a different member of staff - difficult to promote consistency.  
• Strong reservations about SoW no time to address. | Lack of ownership of the planned work and teachers tended to modify the scheme according to their own values and beliefs.  
Very little agreed understanding of SoAs interpretation.  
Monitoring would result in less freedom and professional judgement would be threatened.  
Where difficulties are encountered with any aspect of SoW individual teachers draw to attention of Head of Department on weekly record sheets.  
+ differentiation material.  
Yr7,8,9 co-ordinators liaise with technicians and individual teachers. |
| 6          | • Consistency developed through joint planning. SoW Working document.  
• Annual review based on discussion and from notes in individual teacher Records of Work.  
• Supporting material provided by science teacher with time allocated.  
• Pupil guidelines helps monitor pupil progress and teacher coverage of SoW. | |
<table>
<thead>
<tr>
<th>Case Study</th>
<th>GASP Assessment Strategies</th>
<th>Comments</th>
<th>Formative/Summative</th>
<th>Involving pupils</th>
<th>Used to inform planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>End of unit tests</td>
<td>Limited in scope time consuming to mark and administer - would like to increase number of investigation but time inhibits at the moment.</td>
<td>Summative</td>
<td>Master record sheet abandoned because unwieldy an uninformative.</td>
<td>Not used to inform lesson planning. Used evaluatively.</td>
</tr>
<tr>
<td>2</td>
<td>Continuous assessments against specific criteria. Very committed to GASP. Content tests.</td>
<td>Marking by pupils sampled by teacher.</td>
<td>Formative and summative</td>
<td>Feedback to pupils variable from teacher. All work returned to pupils with copy of mark scheme. Content tests marked by pupils.</td>
<td>Targets given to pupils following assessment.</td>
</tr>
<tr>
<td>3</td>
<td>Gasp explorations and end of unit tests. Sc1 done badly, because GASP criteria unfamiliar and at odds with NC</td>
<td>Teacher assessment done in &quot;an amazingly arbitrary way.&quot; Based solely on SoAs the tests had addressed. Teachers lost their way and had taken too much on with NC and GASP. Lack of emphasis on predicting.</td>
<td>Formative/Summative predominantly summative.</td>
<td>Feedback immediately on results of tests - although not linked directly to NC. Will provide termly reports on progress and set targets for pupils.</td>
<td>Not used.</td>
</tr>
</tbody>
</table>
### Table 7 continued.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>GASP</th>
<th>Assessment Strategies</th>
<th>Comments</th>
<th>Formative/ Summative</th>
<th>Involving Pupils</th>
<th>Used to inform planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td>Largely by end of GASP but abandoned when school introduced profiling.</td>
<td>Guideline sheets for each unit used erratically.</td>
<td>Summative</td>
<td>Guideline sheets used by some teachers. Some teachers encouraging pupil self assessment - may fall into disuse because of time it takes to teach pupils how to use self-assessment sheets.</td>
<td>Not used.</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Classroom/ homework used for assessment purposes.</td>
<td>Assessment criteria agreed in advance by department by discussing and agreeing interpretations of SoAs.</td>
<td>Formative predominately feeds into summative.</td>
<td>Assessment criteria shared with pupils who are involved in self and peer assessment.</td>
<td>Used for day to day planning of work and also for re-grouping pupils.</td>
</tr>
</tbody>
</table>
Table 8

Standardisation and Agreement Trialling - consistency, professional judgement.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Agreement Trialling - description of how undertaken</th>
<th>Comments</th>
<th>Experience of GCSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Did not take part in any standardisation of pupils work nor any agreement trialling other than the training in agreement trialling organised by the LEA in preparation for the end of Key Stage voluntary pilot.</td>
<td>The experience of the pilot has highlighted the need for the department to engage in agreement trials and there are plans to incorporate agreement trials as a feature of department days in the future.</td>
<td>Very little experiences of GCSE.</td>
</tr>
<tr>
<td>2</td>
<td>Agreement trials were held throughout the three years as part of the GASP process. This involved a great deal of discussion about pupils work and it meant that all the department were working to the same standard.</td>
<td>The agreement trialling involved GASP levels and there was very little focus on NC levels. When the Department did take part in the LEA agreement trials at the end of KS3 the department was satisfied it had a universality of standards for all ATs except of Sc1.</td>
<td>Considerable experiences of GASP procedures.</td>
</tr>
<tr>
<td>3</td>
<td>The department undertook some agreement trialling after the LEA training for end of Key Stage 3 assessment.</td>
<td>This was very hurried and showed the department the need to do much more agreement trialling. It was evident from the agreement trialling that people do not apply the same standards.</td>
<td>Considerable experience but was not drawn upon.</td>
</tr>
<tr>
<td>4</td>
<td>The department had not held any agreement trials for moderating pupils work not had they not thought it necessary to discuss and standardise individual teachers assessment.</td>
<td>Replied solely on professional judgement of each individual teacher.</td>
<td>The experience of GCSE and the demands made by Examination boards on coursework marking had helped the department cope with the demands of KS3.</td>
</tr>
</tbody>
</table>
Table 8 continued

Standardisation and Agreement Trialling - consistency, professional judgement.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Agreement Trialling - description of how undertaken</th>
<th>Comments</th>
<th>Experience of GCSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Involving only Sci just prior to end of Key Stage.</td>
<td>The department regards its lack of common goals and values as its biggest problem. This lack of commonality is largely due to variation in experience and the confidence of different members of the department.</td>
<td>The Examination Board support for assessment at KS4 has been of excellent quality. The Board demands assessment and moderated materials - so department practice much better at KS4 than KS3. Examination Board was a useful coercer.</td>
</tr>
<tr>
<td>6</td>
<td>Regular agreement trials and all movement between sets is conducted on the basis of looking at pupils work and discussing and agreeing the attainment it represents.</td>
<td>The department plans all schemes of work together so aiding the standardisation process and all teachers assess against discussed and agreed criteria.</td>
<td>Department teaches a co-ordinated Science GCSE so the requirement to moderate across subject specialism and teaching groups was very useful and had been built on at KS3.</td>
</tr>
</tbody>
</table>
Table 9

Decisions about appropriate entry to tiers for end of Key Stage Assessment and early opening of papers - professional judgement.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Basis of entry to tiers</th>
<th>Early opening of papers</th>
<th>Agreement with outcomes of end of Key Stage tests</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Professional Judgement.</td>
<td>Yes - to make suitable arrangements for pupils with ESL and SEN.</td>
<td>Over-estimated pupils levels, particularly in Tier 5-8 several pupils were thus awarded W.</td>
<td>At the time of opening the tests the department did not anticipate any difficulties so no last minute changes were made.</td>
</tr>
<tr>
<td>2</td>
<td>Used GASP level to rank pupils and entered those with GASP levels 6 or above in the 5-8 tier. Level 4/5 were entered for 4-7 tiers and everyone else for the 3-6 tier.</td>
<td>No - did not open tests in advance.</td>
<td>Pupils taking Tier 5-8 gave rise to the majority of Ws. Tier 3-6 gave rise to W. Tier 3-6 gave rise to W. None at Tier 1-4.</td>
<td>Just prior to tests HoD got cold feet and used all level 3-6 papers available. By and large agreement average level was 5. School predicted 5.5</td>
</tr>
<tr>
<td>3</td>
<td>Based on sets. Originally top two sets entered for 5-8 tier (60 pupils) remaining sixty entered for 3-6 tier. After opening papers entered the top 40 from year 8 exams in tier 5-8 and all remaining pupils in the 3-6 tier.</td>
<td>Yes - opened in advance to make arrangement for statemented pupils.</td>
<td>Several pupils in 5-8 tier received a W, but only 1 pupil from the 3-6 tier received a W</td>
<td>Early opening brought about a change in entry decisions.</td>
</tr>
</tbody>
</table>
Table 9 continued.

Decisions about appropriate entry to tiers for end of Key Stage Assessment and early opening of papers - professional judgement.

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Basis of entry to tiers.</th>
<th>Early opening of papers.</th>
<th>Agreement with outcomes of end of Key Stage tests.</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Department had geared its own test results and professional judgement decisions made for entire sets.</td>
<td>Yes</td>
<td>Only one child possibly mis-entered in the appropriate tier.</td>
<td>Exemplar material used to give mock SATs to finalise decisions about entry for tiers.</td>
</tr>
<tr>
<td>5</td>
<td>Yr9 pupils given tests which covered Sc2, 3 and 4.</td>
<td>Yes - no last minute changes because pupils had already been informed which test they would be taking.</td>
<td>For majority of pupils got decision about right. Some apparently lower ability pupils did better than expected.</td>
<td>The department feels they were advantaged by the support given to them.</td>
</tr>
<tr>
<td>6</td>
<td>Decided on the basis of teacher assessment which had been maintained throughout the key stage.</td>
<td>Yes - but no last minute changes to decisions.</td>
<td>Close match between TA and end of key stage tests. A small number of pupils entered in 5-8 tier received a W.</td>
<td>Teacher assessment was validated by tests - close match.</td>
</tr>
<tr>
<td>Case Study</td>
<td>How common agreement is achieved.</td>
<td>Comment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>----------------------------------</td>
<td>---------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>No common agreement - reliant on the professional judgement of individual teachers through their lesson plan.</td>
<td>Department scheme ensures planned coverage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Frequent discussion by all members of department. Where doubts existed the actual questions issued on tests became the interpretation of SoAs.</td>
<td>Department had been involved with CATs team developing BATs (bits of assessment tasks) for two years. Consistency was achieved by the department agreeing that whoever wrote the test items had responsibility for the interpretation of the statement. Interpretations of SoAs had been attempted on a training day but had proved to be very time consuming.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>No common agreement other than for Sc1-where all the department sat down with pieces of work and moderated. Otherwise - relied on publisher's interpretations.</td>
<td>Experience of Sc1 moderation showed department the need to do much more agreement trialling if they are to ensure consistency of standards and expectations. Despite the departments experience at GCSE the moderation was not done well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Relied almost exclusively on the interpretation of SoAs displayed by publishers material.</td>
<td>The department had not thought it necessary to agree a common interpretation as they had complete faith in the publishers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>There is considerable diversity about the interpretation of SoAs due to the distribution of SoAs and the delegation and distribution of the preparation of SoWs. There is no complete common agreement, the writer of the scheme interprets the SoA.</td>
<td>There is understood to be a shared professional judgement and shared values although this is not necessarily the reality.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Weekly meetings with rolling programme for collectively planning schemes of work - involving reaching agreement about interpretations of SoAs.</td>
<td>Involved with CATs team in development of BATs so department has spent some time with other teachers unravelling and amplifying SoAs.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case Study</td>
<td>Use of Support Materials</td>
<td>Comment</td>
<td>Inservice</td>
<td>Comment</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------</td>
<td>---------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td>1</td>
<td>Very little use.</td>
<td>Impossible to keep up with. Parts used on Inset courses had shown the usefulness of material. Would endeavour to use in future.</td>
<td>Early Inset on familiarisation very useful. End of KS3 Inset appropriate and pertinent. Subject specific had been very useful. But the other Inset consisting of sharing what you had done was not helpful. Too little emphasis on Sc1.</td>
<td>Teachers wanted to be presented with solutions not to share their ignorance. Sharing of ideas would have been very welcome here.</td>
</tr>
<tr>
<td>2</td>
<td>Filed centrally, very little read.</td>
<td>Far too much. Impossible to keep up with it. Not even sure if they have a full set.</td>
<td>Inconsistent and somewhat &quot;bitty&quot; overall the training was considered to be about as good as could be expected given the many changes and uncertainties.</td>
<td>More was provided than in other LEAs. Greater co-operation and collaboration between school would have been welcome.</td>
</tr>
<tr>
<td>3</td>
<td>School assessment folder used on school development day. Otherwise nothing used.</td>
<td>It was valuable but was needed earlier 3 day conference for HoDs very useful. Otherwise not enough Inset for dept.</td>
<td>HT concerned about whole school issues so distracts from dept development.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Did not use</td>
<td>Much had been useful - but variable in quality.</td>
<td>Inset which brought teachers together to plan units of work was useless. Would welcome more support for Sc1.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inset for end of KS3 was appropriate.</td>
<td>Once all the moaning and griping had been filtered out.</td>
<td></td>
</tr>
</tbody>
</table>
Table 11 continued.

Use of support material and effectiveness of INSET

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Use of Support Materials</th>
<th>Comment</th>
<th>Inservice</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Used school assessment folder. Read all guidance material and used a lot of it.</td>
<td>Some good assessment advice was contained.</td>
<td>Inset provided by LEA was not useful.</td>
<td>They do not like sharing ignorance with others.</td>
</tr>
<tr>
<td>6</td>
<td>NSG was NCC booklet on investigations found Teacher Assessment in practice very useful and the Exemplification materials. Pupils Work Assessed.</td>
<td>Read all documents produced by SEAC.</td>
<td>Took part in Inset provided by LEA, the Institute and by Kings college an by the publishers of schemes used. Found almost all of it useful to varying degrees.</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER SEVEN

Lessons learnt about change

Preview

Chapter 4 outlined how the various external agencies communicated to schools and others their particular vision of the changes required to implement the National Curriculum. In Chapter 6 the case studies described the realities of change as seen by the schools. This chapter considers what can be learnt about the management of change from the case studies. The purposes of the National Curriculum are reiterated, as are the nature of changes facing schools and a model of the process of change and the four stages of the change process are considered.

The case studies are examined to see how schools coped with the process of change. The chapter also looks at the external and internal support for change within schools and considers was there an appropriate balance between the process of change and the content of the change both internally and externally? The case studies are also used to look at how heads of departments acted as change agents.

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Purpose of the National Curriculum

The National Curriculum was intended:

- to raise standards;
- to foster continuity between the phases of education;
- to increase the accountability of teachers.

In the information pack produced by the National Curriculum Council the intentions of the National Curriculum were stated more fully:

- to give a clear incentive for the weaker schools to catch up with the best and the best to be challenged to do even better;
- to provide teachers with detailed and precise objectives;
- to provide parents with clear accurate information;
to ensure continuity and progression from one year to another, from one school to another;

- help teachers to concentrate on the task of getting the best possible results for each individual child.

The National Curriculum Council also outlined the actions teachers would need to carry out in preparing for the implementation of the National Curriculum:

- extract relevant information from the reports of the working groups and NCC advice to the Secretary of State;
- study the Statutory Orders for subjects when they are published and also the Non-Statutory Guidance;
- compare the Statutory Orders with existing teaching schemes and draw up a plan of action to ensure that all the prescribed programmes of study are taught;
- prepare and adapt resources;
- plan for recording pupils' progress;
- prepare for continuous assessment of pupils.

The processes outlined above are very time consuming and whether one agreed or disagreed with the stated intentions of the National Curriculum those intentions would clearly not be realised unless they were managed at a variety of levels within the school since they have implications for the organisation of teaching and learning, at classroom, department and school level. The implementation of the National Curriculum Science was a radical change and departments faced the following changes.

- Changes in the breadth and depth of the curriculum at Key Stage 3.
- Changes in the way they viewed pupils' previous science experience.
- Changes in the structure and organisation of the curriculum.
- Changes in the approach to scientific investigations.
• Changes in assessment.
• Changes in working practices.
• Changes in accountability.

To adapt and cope with this range of changes required a skilled and willed groups of teachers who were deftly managed.

This research looked at the National Curriculum Science during the first three years of implementation and covered the first run through Key Stage 3 and it raises a number of questions and issues. Political pressures to get the National Curriculum implemented rapidly in at least the core subjects meant that the process of changing to the National Curriculum did not divide neatly into a planning and implementation stage it is therefore necessary to consider.

• Did the implementation ensure that teachers understood the changes required and did it encourage their commitment to the changes?
• Curriculum development cannot take place unless it is accompanied by teacher development. How was this achieved?
• What were the opportunities from the earliest pre-legislative consultations to the end of Key Stage 3 tests?
• Nationally and within the LEA how receptive was the climate for change?
• How did the culture of a particular school affect the process of change?
• Were there tensions between the need for change and a desire for the continuation of the way things were?
• Did the reassurances about building an existing good practice given by the Science Working Group, the NCC and SEAC aid or hinder the implementation of the National Curriculum? Was it honest? Does not all change imply some measure of discontent with the current situation?
• In terms of the curriculum and its assessment were there tensions created from the outset which may have prevented schools from viewing assessment as truly linked integrally to the process of learning?

• During these three years did the bodies responsible for helping schools cope with the change achieve and appropriate balance between the content of the changes and the processes of change?

• Were the visions of the change communicated effectively and did the change agents within the school receive sufficient support so that they acquired their own version of the vision of change.

• On the issue of continuity and progression was sufficient account taken of the different cultures of primary and secondary schools?

• During these first three years, as problems were encountered with the curriculum, but most particularly with the assessment of the curriculum, science teachers were subjected to several changes in the structure of the orders, what effect did this have on the will and skill of the profession?

• What evidence was there that curriculum development would be achieved by sending to schools extraordinarily complex written documents?

• Was sufficient attention given to the role of Head of Department in leading and managing the changes?

Those who want to implement change have a sizeable educational task on their hands: they have to help everyone concerned to discover and conceptualize the true nature of change and how it impinges upon us all. Change will affect beliefs, assumptions and values, and be affected by them. Change will alter the way we are expected to do things. And change will alter the things we need to do them with.” (Everard and Morris (1985) P.170)

Thus it was at this early stage particularly difficult for Heads of Departments to lead their departments in coping with the change.

The curriculum had to be implemented with relative haste and the case studies show that all schools understood the need for some change. All schools reviewed their schemes of work and made changes in various ways, ranging from abandoning the scheme of
work already in place and replacing it with a publisher's scheme (Case Study 3) to slotting the statements of attainment into their existing schemes (Case Study 4).

It is evident that teachers were not completely clear about the changes required because only Case Study 6 recognised the importance of the Programmes of Study and used them in their planning. During the period of consultation the SWG had at one time in relation to specific attainment targets, expressed the view that they should be age-related and certainly in Case Study 3 this notion pervaded throughout the period of the research.

In terms of assessment, schools were not all clear about what was required of them and despite the fact that several schools had experience of GASP, the predominant mode of assessment was end of unit tests. With the exception of Case Study 6, schools did not have a clear understanding of the relationship between curriculum design and its assessment.

The variation in approaches adopted by the six schools in planning the implementation of the National Curriculum also shows that there was a lack of clarity about what was required. In managing the change several Heads of Department took the evolutionary approach which reflects their understanding of the change process, but in the case of Case Study 1 the process based approach, which they had used in the past and had recognised shortcomings was held on to by the department for Y7 and Y8 which indicates to some extent either a lack of commitment to the changes or a misunderstanding of the changes. Case Study 5 with its minimalist approach of slotting attainment targets into its existing scheme indicates very little commitment on the part of the Head of Department or the staff. "Organisations are dynamically conservative: that is to say, they fight like mad to remain the same. Only when an organisation cannot repel, ignore, contain or transform the threat, it responds to it. but the characteristic is that of least change: nominal or token change. (Donald Schon, 1971 Reith Lecture). Within the other schools the range of attempts to plan for the new curriculum indicates a range in commitment to the changes. Case Study 2 and Case Study 6, both of which had considerable involvement with external agencies at the development stage, show the greatest degree of commitment to the changes.

Again, with the exception of Case Study 2 and Case Study 6 most schools did not understand the need for or have any commitment to reaching agreement about interpretation of statements of attainment or of agreement trialling and the need for standardisation. When schools took part, toward the end of Key Stage 3, in agreement trialling the majority understood the need and intended to alter their approach in the
following year. Case Study 4 and 5 remained unconvinced of the importance of agreeing interpretations or of standardisations.

"Fullan (1991) stresses the importance of effective communication within a school during improvement initiatives. He notes that no amount of good thinking by itself will address the ubiquitous problem of faulty communication". (Hopkins, Ainscow, West 1994 p.171) There was clearly some faulty communication from the central bodies to the schools.

"Since change is a highly personal experience, and since schools consist of numerous individuals and groups undergoing different (to them) experiences, no single communication is going to reassure or clarify the meaning of change for people. A cardinal fact of social change is that people will always misinterpret and misunderstand some aspect of the purpose or practice of something that is new to them.” (IBID)

Curriculum development does not take place in a vacuum and it is only achieved when the teachers involved are committed to the development, this means that there are always associated teacher development needs when the curriculum is being developed and teacher development during the three years of the research could have occurred through three areas. Firstly, teachers are developed by working in a particular schools and by the interactions teachers have with others. Several of the Heads of Departments recognised these opportunities for development by ensuring that teachers had opportunities to discuss the curriculum, that teachers worked together collaboratively to plan schemes of work and assessment strategies and in discussing statement of attainment and in undertaking agreement trials. (Specifically Case Study 2 and Case Study 6 but also Case Studies 1, 3 and 5). Hopkins, Ainscow and West writing on a "School improvement in an era of change" notes that Andy Hargreaves’ work strongly supports the notion of collaborative cultures as being an essential building block for school improvement". p.94) Fullan and Hargreaves state that “collaborative cultures, facilitate teacher development through mutual support, joint work and a broad agreement on educational values. Within schools that possess collaborative cultures ‘the individual and the group are inherently and simultaneously valued’.” (Fullan and Hargreaves, 1992, p.67).

Two of the schools (Case Study 2 and Case Study 6) also had the opportunity for teacher development afforded by their involvement in developmental work with the CATS team who were involved in the initial stages of developing standard assessment tasks. Similarly, several of the schools had been involved with the GASP scheme and
in Case Study 3 somewhat ambitiously the school had started the GASP scheme at the same time as the National Curriculum.

Teachers can also be developed by the provision of In-service training and all the case study schools apart from Case Study 5 benefitted to a greater or lesser degree from the Inset provided by the LEA and others. Heads of Department particularly benefitted from the residential conference just prior to the implementation of the National Curriculum.

During the period of implementation of the National Curriculum the way in which In-service training was funded was also subject to changes and this meant that schools released different teachers for different aspects of the training and as a result there was fragmentation and dilution of the effects of the training. In-service training providers were themselves sometimes in the dark as they received almost no training for the implementation of the National Curriculum. Unless advisory staff made deliberate and strenuous efforts to take themselves through some of the issues facing schools, they had very little understanding of the nature of changes required or how they could best support teachers with those changes.

The predominant emphasis of support for the National Curriculum took the form of written guidance (see Chapter 4) starting with the Non-Statutory Guidance from the NCC through a welter of materials culminating in the information from SEAC on the administration of the tests. Case Study 1 showed that it felt that an enormous amount of material had been sent to schools and that it arrived at such a rate that it was impossible to keep up with the reading required and so the department had made very little use of it. Case Study 2 had filed the material but had some doubts that it had a full set of the materials. Again, this school highlights the opportunities for misunderstandings and inconsistencies, as in the words of the head of department “the department dip into the contents from time to time”. In contrast, Case Study 3 had used some of the information on a school development day and found it useful but they would have welcomed specific guidance on how to sort out assessment. Case Study 5 had not taken very much part in the In-service provided by the LEA but they had read all the guidance produced and used a lot of it. This is a particularly interesting point as this department of the six schools studied appeared to have adopted a minimalist approach to the National Curriculum and certainly the practice of the department did not match or reflect the guidance given in the documents. There may be a difference in perception or they may have interpreted the guidance in a particular way. Case Study 6 had also studied all the materials produced and there was a clear and evident match with the approaches suggested in the guidance and the practices of the department.
During the period from the publication of the SWG Interim Report to the end of Key Stage 3 tests (pilot) there were many opportunities to shape the thinking of science teachers with regard to the curriculum and its assessment. During the early stages of consultation there may have been a tendency to get distracted from the issues of how science education can best meet the needs of pupils to a concern with ultimate definition of progression of knowledge and understanding in a particular concept and also by the unfamiliar structuring of knowledge, understanding and skills in the format of the National Curriculum. From the responses to the consultation it seems as if teachers and others were checking that their particularly favourite topics or issues with regard to science had been included rather than what might be the effect of this curriculum proposed on children’s understanding and development of knowledge in science. Similarly, the TGAT Report did stress very strongly how pupils development could be assessed and also the range of attainments pupils of the same age may demonstrate, but certainly during the three years of the study, schools appeared to make little attempts to acknowledge the importance of a variety of assessment methods or to use them. In almost all the case study schools there was some difficulty in coming to terms with planning a curriculum on the basis of pupils different rates of progress or to build on pupil’s earlier science experience (see Case Studies with regard to use of transfer documents and also in using assessment to feedback to pupils and to plan their next step).

In the early stages of implementation once schools were underway they tended to work on automatic pilot and it was not until Y9, 1991 - 1992 that the schools became fully aware of what would be required with regard to the assessment of pupils at the end of the key stage and it is interesting to note that to some extent departments then tried to adapt or change their practice to go some way to meet the demands. Case Study 4 had a science “cram day” and extorted parents to help with revision. In Case Study 5 at a very late stage pupils were required to plan an investigation for the Quality Audit. Other case studies had begun to see issues for their practice with regard to agreement trialling by the training provided for the preparation for the end of Key Stage 3. This bears out my point that if there had been clarity from the outset about what would be required by the end of the key stage, teachers would not have needed reams of documents telling them what to do. They would have evolved their practice accordingly.

In terms of the outcome of end of Key Stage 3 tests some schools had their expectations of some of the lower achieving pupils challenged by the test results. Almost all schools by the end of Year 9 1992 had decided that their practices had to be
altered in some way because of their experience of the first run through, is this not what evolution is all about!

Teachers in Case Study 2 made an important statement that in terms of the outcomes of the tests their schemes of work and practice had served them well but in terms of a learning tool which motivated pupils and which teachers enjoyed teaching it had certain shortcomings. They had addressed their accountabilities but they were professionally dissatisfied. Several schools also mentioned they made U-turns or altered their plan according to what they heard from various sources during the key stage. There is no doubt that there was throughout the key stage in almost all schools, perhaps with exception of Case Study 2 and Case Study 6, a considerable degree of confusion about exactly what was expected from schools.

“Lack of clarity about the goals and means of effecting change is a problem. all who are affected by the change need a clear picture of what it will mean for them: what will they be doing differently, after the change has been implemented? They want to know specifically what it means in practice for them ... clarity is not something which can be pre-packed in some sort of blueprint; it is something that grows through dialogue and questioning. (Everard and Morris (1985) p.188).

By the time the Science Orders had been made law, most teachers nationally and locally had accepted the need for change and there was very little resistance to the idea of a National Curriculum, there were still some reservations and difficulties about how the accountability of teachers would be addressed and also about the use of league tables. Within the LEA, schools should have been reasonably receptive to the change given that the Authority had its own curriculum policy and testing at 7, 11 and 14 and also given that schools were heavily involved with GASP and within the LEA there was also a good match between teachers qualifications and the subjects they taught. In the LEA Science Inspector’s report concern had been expressed about the prominence of illustrative work rather than investigative work and the Inspector had also drawn attention to the lack of specify of learning outcomes and good assessment practice. Concern had also been expressed about the lack of development of continuity between the primary and secondary phases and also between the lower secondary years and the examination classes of the upper school. Whilst, therefore, there was to some degree a fertile seed-bed laid down, it was not in all respects the most ideal conditions for developing a new curriculum, but most certainly it was probably as ready for the change as any other LEA in the country.
During the period of research it seems clear to me that whilst both the SWG and TGAT wanted an evolutionary approach that built on and extended current good practice the Government was determined to ensure that teachers became more accountable for their work and that there should be some sort of national ranking system for schools.

Within the LEA the cultures of the individual schools varied enormously and this had considerable impact on how the school approached the implementation of the National Curriculum. In addition to the collaborative culture already described Hargreaves draws a further three contrasting cultures of teaching.

**Fragmented individualism** occurs where the teacher is isolated, is protected from outside interference, and at times takes refuge behind the 'sanctity of the classroom door.' It reinforces uncertainty and insulates the teacher from positive feedback and support.

**Balkanisation** describes a teacher culture made up of separate and sometimes competing groups jockeying for position and supremacy like loosely connected city stages. ...The existence of such groups often reflects and reinforces very different group outlooks on learning, teaching styles, discipline and curriculum.

**Contrived collegiality** occurs where the forms of collaboration are determined by administrators not teachers. As a result they are usually regulated, compulsory, implementation oriented, fixed in time and space and predictable.

Certainly within the case study school, in addition to the collaborative cultures displayed by case study 2 and 6, fragmented individualism and balkanisation were evident.

In the Case Study 5, individual teachers enjoyed considerable autonomy and freedom with teachers employing their own style and interpreting the same worksheet differently. Each module was written by a different member of staff and it was difficult to promote consistency because there was a lack of ownership and teachers tended to modify the scheme according to their own values and beliefs. The staff were concerned that too many developments were taking place at once and this school experienced particular difficulties as so many of the science staff also had senior management responsibilities. Inconsistencies with approaches were also compounded in this school as they felt that any attempt to monitor the curriculum would curtail the individual teachers freedom and that their professional judgement would be tethered and undermined.
Case Study 3 had also had difficulties with regard to taking on too many changes at once and had relied fairly heavily on a publishers scheme which they later found to be less than satisfactory. This department displayed a degree of confusion about what it was trying to achieve and it was certainly not meeting the Government's view that through the National Curriculum parents should be provided with clear information about the curriculum and how their children are progressing. The experience of Agreement Trailling showed the department that they did not apply consistent standards and they also had no faith in the interpretation of standards of attainment of primary teachers nor had they discussed how best they could build on pupils' previous experience in science.

Teachers in both Case Study 1 and 2 worked together to analyse their current schemes of work and adapt them to the National Curriculum and the teachers were happy to have the support of the scheme of work produced by their efforts. Case Study 2 had made serious attempts at discussing interpretation of statements of attainment and promoting consistency but realistically accepted that where there were differences - there were differences.

Case Study 5 which was a relatively inexperienced department used a published scheme but unlike, Case Study 2 and 6, Case Study 5 relied fairly heavily on it. Case Study 6 which had been used to working collaboratively for some years previously continued to adapt and develop this approach as they implemented the National Curriculum. They exploited the National Curriculum to meet their own clear aims for science education.

The case study schools show that there was considerable tension and misunderstanding about the relationship between the curriculum and assessment from the outset. Case Studies 2 and 6 seemed to understand and acknowledge the relationship between curriculum design and assessment and made strenuous efforts to use a variety of assessment techniques and to assess the work produced by pupils in normal classroom activities and by so doing would inevitably prepare pupils for end of key stage assessment. The other case study schools tended to see assessment as a bolt on activity and to use end of unit tests as the mode of assessment. The decision nationally, to separate the NCC from SEAC can only have exacerbated the tensions between the curriculum and its assessment, consequently, schools were not at all clear about what would be required from them in terms of assessment which meant they responded by a proliferation of record sheets which fell into disuse because they were unwieldy and unmanageable (as in the Case Study 1) or in Case Study 3, where the department retained all evidence of pupils work. In Case Study 3 also, the administration of the
assessment scheme was so time consuming that pupils in one group appeared to be making poorer progress than other groups, the reality was that the assessment scheme was administratively so complex that the teacher, overburdened with other responsibilities, could not keep up with the time taken to administer the scheme. In Case Study 6, where the curriculum and its assessment were integrated, pupils’ and parents were given information about what pupils should do next and groups were organised so that there could be an appropriate match between pupils learning needs and the curriculum provided.

To some extent the approaches of some of the case study schools could be understood. Schools were being told by the SWG and TGAT that their proposals were not radical, that they were an evolution based on current good practice. These schools were in an LEA which was regarded at the time to be in the forefront of national practices, they were also very involved with the GASP scheme which the LEA Inspector had confirmed in his report just prior to the implementation of the National Curriculum, had many of the characteristics of the scheme which would be required under National Curriculum. Schools are very insular and to date I have not met a school or department which does not consider itself to be a beacon of good practice. To some extent these reassurances by the national bodies about building on good practice might have led to a degree of complacency from some of the schools. Any effort to undertake change must surely start from a perspective of at least some dissatisfaction with the current approach - or why bother to change? (Everard and Morris 1985)

In terms of the written guidance and to a large degree in terms of the In-service provided much of the focus was on the content of the change, for example, on the residential training for Heads of Department, considerable time was spent on issues concerned with teaching Earth Science and Astronomy. Schools were involved in a massive overhaul of their curriculum and its assessment and certainly while it is important to focus on the content of the changes involved it is probably more important to focus on the process of change.

Joyce and Showers (1988) and Fullan (1991) indicated that despite all the efforts and resources that have been drawn upon much INSET is disappointing in terms of improvements in teaching and better learning outcomes. In reviewing the available research evidence Fullan (1991, p.316) provides the following summary of the reasons for the failure of In-service education.

- One-shot workshops are widespread but are ineffective.
• Topics are frequently selected by people other than those for whom the in-service is provided.
• Follow-up support for ideas and practices introduced during in-service programmes occurs in only a very small minority of cases.
• Follow-up evaluation occurs infrequently.
• In-service programmes rarely address the individual needs and concerns of participants.
• The majority of programmes involve teachers from many different schools but there is no recognition of the differential impact of positive and negative factors within the system to which they must return.
• There is a profound lack of any conceptual basis in the planning and implementation of in-service programmes that would ensure their effectiveness.

Change is not an event, it is a journey and has certain defined stages which need to be considered if the change is to have any chance of success, but I consider the balance was too strongly in favour of the content of change and not on the process of change. (Everard and Morris 1985)

During the run up to the implementation of the National Curriculum Science, science teachers were involved in a series of consultative exercises concerned with the structure and content of the National Curriculum and its assessment. When the Science Working Group (SWG) and the Task Group on Assessment and Testing (TGAT) published their reports at Interim, Final and in the case of TGAT, Supplementary Report stages, teachers and other interested parties had an opportunity to comment on their proposals. To some extent these consultative exercises were the first steps in managing the process of change and the raising of awareness of teachers about the scale of the changes required had begun. The consultative process could be regarded as fundamental in helping to foster the appropriate climate of change, in reality, for science teachers the change was from a free choice, where science teachers themselves had created the pressures for change and had initiated and implemented them, to a highly structured curriculum accompanied by the spectre of accountability. The consultation process, was also to some degree responsible for causing some measure of confusion, as particularly initially, the focus had been on attainment targets and issues of progression which meant that in several schools the Programmes of Study were completely overlooked. In addition, in one of the case study schools the SWGs one time proposal that some of the attainment targets should be age-related gave rise to an understanding that for example a level 3 in a particular attainment target meant something different at Key Stage 2 and Key Stage 3.
Furthermore, whilst the SWG had commanded the respect of most members of science education their enthusiasm and zeal for the task meant that they produced a curriculum which tried to be all things to all men and it was in grave danger of becoming unmanageable before it was implemented. Essentially, the response of the SWG was wholly understandable and the problems with the Final Orders arose because of the political urgency to establish the National Curriculum and to do so by establishing separate subject working groups instead of looking at the demands the curriculum should make on pupils during the Key Stage in a holistic manner.

The Implementation of the National Curriculum Science and the process of change which were necessary to implement it started with the setting up of the SWG and the TGAT.

The reports issued by these groups helped prepare teachers for the changes which were to follow. The national bodies such as SEAC and NCC added further detail to the National Curriculum and its assessment. The implementation of the National Curriculum by teachers, led by Heads of Departments can be viewed as a process of change which needed to be managed. There are many models of the management of change and the Touche Ross model below embodies many of the features of the various models.
The Touche Ross Approach to Managing Change

1. Define the vision
2. Diagnose the situation
3. Assess changes needed
4. Determine the actions
5. Take the action
6. Evaluate the outcomes
7. Manage the change

Effective Management of Change
Penny Ebram in Developing Managers in Education. CRAC 1991

Fig. 4
How does the model relate to the way in which the case study schools implemented the National Curriculum?

It is clear that within the school the Head of Department with other members of the department had the responsibility for “defining the vision” as it would apply to their school. In order to do this they had to develop their own version of the vision of change. This was particularly difficult in the case of the implementation of the National Curriculum because by the time the Final Orders reached the statute book there was a compromise between the visions of several factions and during the process from establishing the SWG to Final Orders, teachers, depending on their involvement in the consultation procedures, were exposed to several different visions.

The publication of the Final Orders was a fresh opportunity to assure congruence with the vision as understood by the National Curriculum Council and the schools, but due to the way in which the Orders were structured the attainment targets were prominent and the Programmes of Study could be found somewhere at the back of the folder. This meant that several of the case study schools did not realise that they should be using the Programmes of Study for their planning, and the attainment targets for assessment. A further opportunity was presented in the Non-Statutory Guidance when again attention was drawn to the Programmes of Study in the flow-chart given to help prepare departments to implement the National Curriculum but not all schools used this. As with many other examples of managing change the process foundered from the outset because of inadequate or poor communication of the vision. In the case of school 5 the department relied totally on the attainment targets for their planning and slotted the attainment targets into their current Schemes of Work. In this case, the Head of Department had been on an exchange to Australia in the year just prior to the implementation of the National Curriculum and this case study illustrates the inadequacy of the communication of the vision and also the fact that the implementation was rushed in the meet political ends. In fact, of the six case study schools only school 6 used the Programmes of Study at the planning stage. Nationally HMI Reporting in Science Year 1 1989-90 reported that very few schools used the Programmes of Study for planning purposes. In the second year HMI noted that “increasing use was being made of Programmes of Study in planning”.

The curriculum was also envisaged as continuum form 5 to 16, so issues of continuity from Key Stage 2 to Key Stage 3 would have been expected to be prominent in the vision of Heads of Department, again in the case study schools with two exceptions no or very little use was made of primary records. In one of the cases where primary
records were used the accompanying pupils work had been reassessed and accredited
with GASP level (see Case Study 2, School C).

However poorly or imperfectly the vision of the curriculum was communicated all
departments had some sort of vision of the curriculum and this is reflected in all schools
altering the structure of the department responsibilities and appointing either Key Stage
3 Co-ordinators or Year Co-ordinators.

In Case Study 1, a matrix was used to identify gaps in their current scheme against the
seventeen attainment targets, and also identified the overlaps and cross-curricular links
with geography, technology and history. Case Study 2, did a similar mapping exercise
of their current curriculum and defined new units they needed to develop. Case Study
5 slotted the attainment targets into their existing schemes. Case Study 3 already had
serious concerns about their current scheme so they started from scratch and their
"diagnosis of the situation" involved analysing the various publishers schemes on
offer to find the closest match with the National Curriculum. Case Study 4 took a
similar approach although they finally settled on a different scheme to that of Case
Study 3. Case Study 6 also used a commercial scheme but one which they had already
been using and extended and adapted it to National Curriculum demands.

In "diagnosing the situation" schools also had to consider their approach to
assessment, and in several cases the diagnosis may have been ill informed or
incomplete because they relied almost exclusively on end of unit tests (see Case Study
1, Case Study 3, Case Study 4, Case Study 5). Several of these schools (Case Study
3, Case Study 4 and Case Study 5) had been involved in the Graded Assessment of
Science Scheme (GASP) so it might have been expected that they would have taken a
more formative approach to assessment. Case Study 2 was the only school involved in
the GASP scheme which endeavoured to approach assessment in a more formative
manner. Case Study 6 also used assessment to develop the learning process.

Having "diagnosed the situation" with regard to curriculum and assessment
schools by adapting their schemes of work and developing their approaches to
assessment were to some extent also "assessing the change needed",
"determining the actions" and B and the frequent references by schools to U-
turns, unhappiness with the scheme as a learning tool, or discovering inadequacies in
publishers' schemes despite their claims, showed that to some extent schools were also
evaluating the outcomes of their actions. All schools also wished to alter their
practice as a result of what they had learnt during the first run through of Key Stage 3.
In planning the curriculum from 5 - 16 either at the SWG level or at the level of the case study school what effect would the different cultures of primary and secondary schools have on issues of continuity and progression? The determination to plan the National Curriculum on the basis of subjects rather than to plan the curriculum in a holistic way for the Key Stage had its impact on secondary school but it had an even greater impact on primary schools. To some extent the difference in cultures of primary and secondary schools could have been a factor in secondary science teachers mistrust of the teaching at primary school and also of the primary teachers ability to make judgements about pupils levels of attainment. Four of the six case study schools made no attempt whatsoever to use the transfer documents which primary colleagues had sent to secondary school when pupils transferred from Y6 to Y7. In three of these four schools the secondary departments assumed that pupils had very little experience of science and planned their curriculum on the basis of all pupils starting from scratch. Case Study 4 had a six lesson introductory course during which they assessed pupils previous learning experience and then on the basis of these assessments pupils were placed in sets. Case Study 2 tried to use the transfer documents with varying degrees of diligence but they found the pupils work which had been sent with the documents much more useful in giving a picture of pupils attainment in science. In fact, this department re-marked the work on the basis of GASP criteria and found some very high levels of achievement. Case Study 6 was part of a liaison group which had developed and pioneered the use of transfer documents and they had used them to ascertain pupils starting points in science and pupil had then been allocated to flexible sets with the curriculum planned in linked units of work with pupils being re-grouped at end of each unit.

The reaction of the four departments who did not use the transfer documents is very interesting, particularly in the case of Case Study 5 where the department acknowledged that if they did use the transfer documents it would be catalytic in causing them to reappraise their practice and they were unable, due to other pressures, to contemplate this at the time!

Any change, needs to be carefully co-ordinated and managed and within the school situation the role of the Head of Department is pivotal. In the early days of 1989 and 1990 because of the phased implementation, the National Curriculum was an issue for the mathematics and science departments only. Furthermore, at this time senior managers in schools were getting bogged down with LMS and other problems, so that the curriculum leadership, normally shown by Headteachers and Deputy Headteachers was in several schools, notable by its absence. This was particularly significant in areas where a whole school approach was necessary, in promoting liaison between
feeder primary schools and in the area of assessment, recording and reporting. The leadership role of the Head of Department was, therefore, more crucial than it had ever been and to some extent there was potential for considerable frustration on the parts of Heads of Departments as they tried to communicate the issues to senior management who were patently out of touch with the jargon, terminology and to some extent the philosophy of the National Curriculum. Science departments were faced with change on a scale never before encountered and in several of the case study schools departments were already coping with a multiplicity of change.

In terms of defining the vision it is clear that whilst the SWG, TGAT, NCC, SEAC, HMI and the Government all had a vision of the National Curriculum and the changes involved it would seem that they all had at the very least different versions of the vision or more likely from the roles they have had in managing the change completely different visions. Schools had to implement the National Curriculum on the basis of their own version of the visions. (Fullan M, 1992)

All departments made some attempt at diagnosing the situation by looking at their current schemes of work and making decisions about whether to adapt or refine their current schemes or to start again from scratch. The favoured option for case study schools was to adapt and extend existing schemes.

Heads of Department management role can also be seen in the ways they involved the department in work to implementation the National Curriculum and in Case Study 1, 2, 3, 4 and 6, to a greater or lesser extent the departments particularly with regard to planning the curriculum, worked collaboratively, shared expertise and to some extent developed professional judgement. Heads of Department also tried to ensure departments were not overloaded by taking some of the routine aspects of the work on themselves without undermining the collaborative practices they were fostering. The management role of the Head of Department is also seen in the way departments were restructured for the implementation of the National Curriculum, in schools 1, 2, 4, 5, Key Stage 3 co-ordinators were appointed and in school 6 Year co-ordinators were appointed. In several of the schools the monitoring and evaluation aspects of the Head of Departments role was also clear, in Case Study 1 the Head of Department visits lessons, team teaches and discusses at department meetings the work of the department. In Case Study 2 the approach to monitoring drew attention to aspects of the administration of the assessment scheme which were unmanageable and apparently hindering pupils progress. In Case Study 4 very little monitoring was undertaken by the Head of Department. In Case Study 5 monitoring of pupils progress was
undertaken by pastoral staff but it was unlikely to feedback directly to departments for evaluation of the management of change. In Case Study 6, both the monitoring of pupils’ progress and the effectiveness of curriculum plans were well thought out, managed and effective.

Heads of Department also had a key role in helping other staff to come to terms with the interpretation of attainment targets, and consistency and standardisation within the department. Case Studies 1 and 4 did not take part in any agreement trialling during the key stage but the experience of the pilot had highlighted to Case Study 1 the need for the department to do so and the Head of Department had made plans to incorporate it into department’s work. Case Study 3 undertook some agreement trialling after the LEA training but school 4 did not alter its decision, did not see any need for it to do agreement trialling.

Case Study 5 took part in some agreement trialling just prior to end of Key Stage 3 coerced by the demands for Quality Audit. Case Study 2 and 6 were all involved from a very early stage in developmental work for SATs with the CATs team and both schools had held regular agreement trials and had discussed interpretation of attainment targets throughout the key stage. Heads of Department develop and hone teachers professional judgement though activities such as planning schemes of work, agreeing interpretation of statements of attainment, agreement trialling and standardisation and though these opportunities help departmental members to come to terms with, and adapt to, the changes required.

There does seem to be in some schools some mixed ideas about what professional judgement is - it seems to range from a highly developed range of skills which are based on knowing your subject, interpreting it consistently by discussing and agreeing with others, using appropriate assessment techniques and recording so the information can be used to plan the next stage of learning, to guesswork, and this is most clearly seen in the way departments approached the decisions about tiers of entry to the tests.

In Case Study 1, the decisions were made on the basis of “professional judgement” and as a result over-estimated pupils’ ability, and despite seeing the tests in advance did not change their decisions, as a result several pupils were awarded a ‘W’. School 2 used Gasp level but when papers were opened there was a disparity between the relationship of GASP levels to National Curriculum Levels and last minute changes were made, similarly school 3 made changes once papers were opened. School 4 used the exemplar material as mock SATs and to reach decision about tier of entry. Only school
6 decided on the basis of Teacher Assessment which had been continuous throughout the key stage.

In implementing the National Curriculum the case study schools to a greater or lesser degree went through the four classic stages of moving towards a change.

- **Refusal**
- **Resistance**
- **Investigation**
- **Acceptance**

Initially, there was refusal to the notion of change both by science teachers and to some extent by the national bodies, for what are the platitudes about the consensus of science education and building on good practice if not echoes of refusal to accept the notion of change. Refusal is also seen in the way schools held on to their current schemes of work and in approaches to assessment and it is particularly seen in Case Study 5 where they just slotted attainment targets into their current scheme, and where the school may alter its practice when coerced to so so by the demands made at the end of Key Stage 3.

Some of the case study schools also showed resistance to the change, for example, the resistance to make use of transfer document or to acknowledge pupils prior learning in science. This resistance can also be seen in the way departments hung on to things which were already in place even when they recognised that they did not match with the requirements of the National Curriculum specifically, Case Study 1 holding on to a very process based approach when the National Curriculum Science was predominately content laden and case study 3 introducing GASP.

Some of the case study schools, realising that change was inevitable, moved fairly rapidly into the investigation phase as demonstrated by such activities as mapping their current curriculum against the requirements of the National Curriculum and looking at published schemes. It is often at this investigation stage that anxiety levels are high, teachers are wanting to know how they will be affected by the change and Heads of Department are called upon to use their leadership skills in reassurance and moving forward the other teachers. This can prove to be particularly difficult when leaders themselves are not wholly convinced about the content of the change proposed or the process by which the change can be achieved. It is clearly evident from the case study schools that there was considerable confusion about the curriculum but most particularly about the assessment requirements. With the exception of perhaps, Case
Study 5, within the first year to eighteen months all schools had accepted the changes imposed by the National Curriculum and this acceptance can most clearly be seen with the way departments complied with the assessment arrangements despite the fact that schools were not informed of these arrangements until very late in the first run through of Key Stage 3. In both Case Study 4 and 5 last minute arrangements were made to comply with the demands made on schools and the other four case studies adapted and accommodated to the requirements fairly easily.

From the case study schools it is clear that the schools fared best when the Head of Department had a clear vision of how the department might best exploit these changes for the good of their pupils, had management skills, encouraged a collaborative working atmosphere and had a strong commitment to the processes involved in the change. These Heads of Department had the necessary change skills. They had

- the capacity to enable change
- the ability to act as a catalyst/innovator
- breadth of vision/ideas
- tolerance of less certainty

Change in a move from the known to the unknown and consequently produces doubts and uncertainties.

This approach can be best seen in Case Study 6 which exemplifies a department confident about their aims and philosophies and so relatively easily accommodated and shaped the demands of the National Curriculum so ensuring the focus remained on effective learning. Whereas in Case Study 5, the department probably suffered because the Head of Department was newly appointed and was absent overseas at the critical early stages of awareness raising so that the Head of Department had little or no understanding of the nature or purposes of the National Curriculum. To a certain extent in school 5, a strong feeling came over that the National Curriculum, far from being an entitlement for all pupils, it was only marginally of interest to the teachers in the school. Some of the echoes and resonances of the Callaghan Speech about producer-domination certainly rang loudly here.

From the first proposals of the National Curriculum the issue of assessment had been central to the debate. It is with the issue of assessment that the plurality of visions
becomes most sharply defined. At one end of the spectrum the majority of schools within the LEA had quite voluntarily joined the Graded Assessment in Science Scheme (GASP) and in several cases had worked extraordinarily hard to ensure that the scheme was successful, as they saw it as a potent force for motivating pupils because of its emphasis on formative assessment, at the other extreme was the thinly veiled desire of the Government to subject all teachers and all pupils to the accountability of the tests. Schools had to cope with the Government vision, having been consulted on the TGAT vision and the SWG vision and also with the vision outlined by SEAC in its guidance. The way in which all aspects of assessment were managed, in an almost breathtaking manner, demonstrated a determination to wrestle with the professional work force and in the process to create a dependency culture. A culture where teachers became incapable of thinking for themselves, and became in most of the case study schools, totally dependent on waiting for the next missive from SEAC.

Summary

This chapter looked at the lessons about the management of change that can be learnt from the case study schools. From the first days of implementation of the National Curriculum there was some degree of poor communication due to the structure of the Orders. Departments also held on to elements of their previous practices even when that practice had shortcomings because to some extent the practice matched reasonably closely with the culture and teaching traditions of departments. The research also highlighted the importance of publishers' schemes in firstly ensuring the entitlement of pupils to the curriculum and also as providing a basis for staff development. When departments used publishers' schemes they were aligning themselves with published schemes' authors' vision for the curriculum.

The implementation of the National Curriculum presented a golden opportunity, when most teachers were not only aware of the need to change but were willing and receptive to change. In some of the case study schools this opportunity was missed.

Paul Black writing in the TES on 23 April 1993 summed up this missed opportunity when he wrote “I think that the mother and father of all mistakes has been to introduce radical changes too quickly”.

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CHAPTER EIGHT

Conclusions

The research was concerned with the implementation of the National Curriculum Science at Key Stage 3 during the years 1989-92 and the purpose of the research was to look at the aspects of the policy and practice which had supported or impeded the implementation. Key Stage 3 was probably the section of the curriculum from 5 to 16 which should have been relatively easy to implement because there was already a close match between the context of the National Curriculum Science and the curriculum previously studied by pupils in the case study schools and science at key stage 3 was taught by subject specialists with the use of specialist facilities with an allocated slot of time on the school timetable.

The first and most important conclusion is that if change is to be achieved the change has to be communicated clearly and concisely to all those involved in implementing the change. The SWG and TGAT had managed to maintain the confidence and commitment of teachers to both a National Curriculum and to its assessment, but when teachers started out on the process of implementation they were unclear about what was required and the case studies give details of the effects of this lack of clarity. Too many different factions had a part in shaping the curriculum and instead of the national bodies sticking to their remit of communicating what would be in the curriculum and how it would be assessed too much of the information sent to schools tried to dictate to schools how they should deliver the curriculum. The Education Reform Act of 1988 specifically prevents the Secretary of State from dictating how the curriculum should be delivered, it is rightly a matter for the professionals to decide. This meant that teachers were confused about what was required but more importantly, it meant that teachers were being de-skilled. An atmosphere was created where skilled professionals abandoned the very essence of their professionalism and started to become dependent on instructions from above.

This also meant that some teachers did not feel involved in the changes and thus showed little commitment to them. Change in practice involves adjustments to the heart and minds of people involved in the change. The change agents need to be both “willed and skilled” and whilst TGAT and the SWG did much to maintain this will and skill of the profession the actions of the national bodies during this period meant that the culture necessary for such an enormous change to take place effectively was never created.
Prior to the implementation of the National Curriculum many teachers had been used to working as individuals within a department rather than as a departmental team, and so the adjustment required by the National Curriculum was for these teachers an enormous one, some of the case study schools embraced this change and worked collaboratively and thus ensured a more consistent curriculum for their pupils at Key Stage 3, others maintained what they considered was their professional autonomy and as a result there were difficulties with the curriculum entitlement enshrined in the National Curriculum. In fact, on the basis of the evidence from the case study schools, there was during the period of the research, no National Curriculum.

Whilst, the Government and others may well have felt that the Orders gave detailed precise objectives to teachers the fact that the Orders were structured with the Attainment Targets dominant and the Programme of Study relegated to the back of the document meant that except in one or two cases, schools were not aware of the purpose or significance of the Programmes of Study and this had a very deleterious effect on the curriculum provided in some of the case study schools.

The decision to structure the National Curriculum on the basis of subjects and to phase the implementation with the core subjects first meant that initially the National Curriculum was seen as only being of concern to the Mathematics and Science Departments. This meant that Senior Management were to some extent becoming alienated from the curriculum and this caused Heads of Science some difficulty and frustration as they tried to lead their department. Furthermore, senior managers were involved in other aspects of the ERA such as local management of schools, and so at the time when whole school curriculum leadership was most needed it was conspicuous by its absence. In some cases, senior managers within schools are now so alienated from the curriculum leadership role that there is a vacuum with regards to curriculum leadership which urgently needs to be filled.

The political imperative to implement the National Curriculum in the core subjects meant that the curriculum was in place before the details of how it would be assessed had been worked out. The resulting problems and confusion meant that teachers have, to a degree, lost confidence in the whole assessment process, this is particularly to be regretted in an LEA which had hitherto made so much progress with the Graded Assessment Scheme and also with the Borough tests which had provided information about how pupils were doing across the LEA.

The initial vision of the SWG for the science curriculum has become lost in the plethora of documents. Too many groups had a part in shaping and defining the National
Curriculum Science and the focus on teacher accountability has meant that the focus on learning has been displaced.

Urgent debate and discussion involving the whole profession and other interested parties needs to take place about the role of investigative work in science and how that should be structured and assessed as many teachers feel that Science is so flawed that they are imposing an artificial and unhelpful methodology of science on their pupils.

The change in funding for Inset meant that the training provided was very fragmented and concentrated largely on the content of the changes and the pivotal role of the head of the department in managing change was not fully supported or exploited. Where heads of department did lead their departments effectively, teachers benefited from the collaborative approach with greater confidence, the curriculum was more consistent and pupils benefited accordingly. In addition, to training heads of departments in management skills they also need training in producing Schemes of Work so they give clear details of desired learning and how this will be achieved and assessed. When they are available teachers rely heavily on Schemes of Work and, because of the pace of school life, almost use them on automatic pilot. This means that to be most effective they need to be very clearly thought out. Many departments rely on publishers’ schemes as the backbone of their teaching scheme and they invest heavily in these schemes, there does need to be some mechanism for checking publishers claims about the coverage provided by their schemes. If we are to have a National Curriculum why do we not have a national body to check these publishers’ schemes?

Where teachers and department had the opportunity to work with outside agencies as in the case of two school working with the Consortium on Assessment and Testing (CATS) the departments seemed to have an accelerated rate of development. The question needs to be asked why they were chosen for this work, was it because they were “good” departments or did they develop and become “good” because of the experience? In fact, both departments were well led and were committed to exploiting the National Curriculum in order to provide the best education experience for their pupils. If good departments develop so much from such contact would not other departments also enjoy significant benefits?

Similarly, throughout the period of implementation many references were made to the ephemeral “professional judgement” but it would seem that very little thought has been given to how professional judgement is developed. The variation in professional judgement in some cases resulted in pupils being under challenged or the provision of the curriculum was such that pupils were unable to clearly demonstrate what they were
capable of. This was particularly evident when school took part in agreement trialling but was also evident when teachers discussed the interpretation of statements of attainment. Heads of department need to give serious thought to how professional judgement is developed. At times during the research I found myself asking what is a department? Is it a collection of teachers working individually, planning their own teaching and closely guarding their professional autonomy, or is it a group of people, working collaboratively, shoring each other up and shaping and developing their professional skills through a common endeavour.

National bodies like SEAC and NCC need to understand that the effect that the very many changes in the structure and organisation of the curriculum had on departments. The conscientious departments to some extent suffered most as they tried desperately hard to alter their practice and to accommodate the changes. On the other hand, some schools do need the force of law to coerce them into changing their practices, in fact one of the schools seemed to respond with alacrity to coercion.

The considerable confusion and waste of time and energy in developing assessment schemes has highlighted that, to be effective, any assessment scheme firstly needs to be manageable. All agencies involved in giving advice about assessment should distinguish between assessment which is designed to foster learning and a system which meets accountability purposes. Teachers should be allowed to decide what is appropriate to promote learning in terms of assessment and if the demands of the accountability of assessment were clearly spelt, teachers would accommodate them just as teachers within the LEA had previously accommodated the Borough tests.

From the outset, there was an expectation voiced that teachers in implementing the National Curriculum, would benefit from the experience of GCSE and coursework marking but in the case study schools several of the schools had only been recently re-organised so there experience of GCSE was very limited. Furthermore the case studies were situated in an area which particularly in the early days of 1989-1990 was still suffering from a high turnover of staff and new staff recruited were largely inexperienced.
For some years issues with regard to the continuity of the Science Curriculum 5-16 have been prominent within the LEA as have issues of progression. The implementation of the National Curriculum at Key Stage 1 and 3 probably exacerbated the disjunction between Key Stage 2 and 3. With two exceptions, schools were unconcerned about liaison with feeder primary schools and in fact there was a general mistrust of the professional judgement of colleagues in primary schools but there was also an arrogance on the part of secondary schools, as viewing primary pupils as empty vessels now to be filled with "real" science. Much attention needs to be given to addressing the issues of understanding the different cultures of primary and secondary schools so that professional respect both ways is developed.

It is unlikely that parents have been provided with clear accurate information particularly as the curriculum has become so jargon ridden and subjected to so many changes. The aim of the National Curriculum of ensuring continuity and progression from one year to another and from one school to another rings a little hollow in the light of the number of u-turns departments were doing as they tried to come to terms with the new curriculum.

Lastly, because the curriculum was planned on the basis of separate subjects rather than as a whole curriculum for a particular key stage, science departments suffered because the SWG had tried to be all encompassing in planning the science curriculum and thus it was too broad and it could not all be delivered and also departments were bombarded by a further range of documents addressing the cross-curricular themes which were used to try to give the curriculum some coherence. In addition to planning their own curriculum, departments in some schools were involved in audits of cross-curricular themes and also in hosting aspects of information technology in science. As a result the demands on the curriculum became too great.

Schools are gradually accommodating the National Curriculum and slowly and steadily heads are being raised and questions are being asked about what has happened to the focus on learning? How can we ensure that the science entitlement curriculum really does prepare pupils for life as citizens in the year 2000 and beyond and also provides a pool of flexible, adaptable scientists? Hopefully, the Dearing Review will ensure that the Science Curriculum now fits in appropriately in the whole curriculum, if it does fit the next essential is to ensure that teachers, parents and pupils are clear from the start of a key stage, not at some point during it, about the assessment arrangements. The prescription of the curriculum and its assessment should be confined to communicating clearly to all interested parties the "what" of the curriculum and clear details of how that
will be assessed, not for formative purposes, but for summative purposes. Then teachers can once more give their attention and energies to ensuring that the entitlement enshrined in the National Curriculum flourishes as intended rather than the prescription merely being palliative in its action.

The most important task is to consider how teachers worn down and enmeshed in administrative detail can be revived and rejuvenated. This will require a fundamental re-orientation of professional development and its provision. The only way forward is to create that “willed and skilled” professional body, that slumbers fitfully at the moment but is ready to be awakened.

In his famous Ruskin Speech, James Callaghan laid the seeds for the National Curriculum. Callaghan said that schools should pay more attention to preparing pupils for working life, reconsider curriculum and teaching methods and be more willing to share power with parents. The research show that during the years 1989-1992 schools did not seem to move any nearer to these goals.

**Where to from here?**

Hopkins, Ainscow and West highlight in “school improvement in an era of change” “that centrally imposed change implicitly assumes that implementation is an event rather than a process; that a change proceeds on auto pilot once the policy has been enunciated or passes. This perspective ignores the critical distinction between the **Object of change** - for example the contents of the Education Reform Acts - and the **process of changing** - that is how school and local agencies put the reforms into practice.” (Hopkins, Ainscow and West 1994, p.17)

In November 1994 schools will receive the revised National Curriculum for implementation in all subjects from September 1995 for pupils’ from 5 to 14, what can we learn from this research so that aims of the National Curriculum are more fully realised during the next few years and most important so that children will get the education they need to prepare for life in the 21st century. Milbray McLaughlin (1990) in her re-analysis of the large-scale Rand Change Agent study undertaken in the USA in the mid to late 1970s found three specific implications.

- Policy cannot mandate what matters.
- Implementation dominates outcomes.
- Local variability is the rule; uniformity is the exception.
If the reforms of the curriculum are to succeed they need to be reinvented in local settings, that is, if the centre to periphery model is to succeed, then in order that those at the periphery (teachers, pupils,) need to feel in charge of changes and see in them purposes which are appropriate to their needs. This means successful sustained change at the classroom level happens when teachers are confident and committed to an ongoing concept of professional development. Schools need to become “learning centred” and create opportunities for teachers to meet together regularly to discuss aspects of their work, share ideas, plan, observe one another’s practice and provide feedback and new approaches. In many schools “teacher autonomy is seen as the ethical basis of professionalism and cornerstone of traditions ... However, this can lead to gross disjunction unless the autonomy is set within the framework of the school and its value system.” (Everard and Morris 1985) It is clear that “implementing change is not a question of defining an end and letting others get on with it, it is a process of interaction, dialogue, feedback, modifying objectives, recycling plans, coping with mixed feelings and values, pragmatism, micro politics, frustration, patience and muddle,” (Everard and Morris 1985, p.171) and whilst many will welcome the promise to leave the curriculum alone for the next five years there will need to be a continuous dialogue between the schools which are trying to implement the curriculum and the policy makers at the centre because “implementation ultimately concerns changes in individual practice.” (Hopkins, Ainscow and West 1994) The challenge must be to look at strategies for professional development - the experience of change can be individually threatening and disconcerting so schools need to foster that learning culture which supports teachers and pupils in the process of change.

INSET providers need to address the issue of developing the work of the department as a team as well as developing their individual thinking and practice. “Quality education is achieved to a large degree by a commitment to the professional learning of teachers that is on-going development and not necessarily circumscribed by particular problems currently faced.” (Hopkins, Ainscow and West 1994, p.113)

Those responsible nationally for assessment should separate formative and summative purposes. They should focus on summative purposes. They should focus on summative assessment which is designed so that it is reliable and valid and these conditions are inherent in the design of the assessment tools, rather than trying to promote validity and reliability through extraordinarily complex arrangements which distract teachers from the process of promoting effective learning.

In terms of involving parents there is a need to restore parents confidence so that they are convinced that teachers know what they are doing and are able to do it well.
Schools need to adopt what Hopkins et al call an incorporative approach, to involve pupils, parents and other members of the community to support school activities.

Hopkins et al suggest that encouraging involvement in schools can be aided by:

- an agreed policy to involve pupils and parents;
- procedures that encourage pupils and parents to participate in decision making;
- parent and pupil understanding of whom to approach in order to comment on policies;
- open discussion between pupils, parents and staff.

(Hopkins, Ainscow and West 1994, p.141)

The challenge for all involved in education locally and nationally is "Schools must now be managed with learning in mind." (Shipman 1990, p.18)

Lifelong learning for teachers and pupils must be the goal.

"Education is a partnership, under the Act as it always was of old. As with any partnership between independently-willed humans, the result has often been imperfect in the past, and no doubt the new-style partnership which includes a powerful Secretary of State will continue to be so. But the right professional approach is, as ever, to keep on trying, to make it work and work better.

(Leonard 1998, p.ix)
Bibliography


ERBAN, Penny, Effective Management of Change In. HOLLY, Peter (1991). Developing Managers in Education. CRAC


LAWTON, Dennis (1989). Education Culture and the National Curriculum.. Hodder and Stoughton Educational, Kent


Department of Education and Science (1989). From Policy to Practice


LEA. The Curriculum Paper, papers relating to Authority Policy (June 1988).
LEA. Chief Inspectors Report 1986-87

LEA. Chief Inspectors Report 1987-88

LEA. Chief Inspectors Report 1988-89


National Curriculum Council (1993). *Teaching Science at Key Stage 3 and 4*


The School Examinations and Assessment Council SEAC Assessment matters No.6 (1991). *Planning and Carrying out Investigations (APU)*


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NATIONAL CURRICULUM SUBJECT WORKING GROUPS
TERMS OF REFERENCE

1. PREAMBLE

1.1 The Government has announced its intention to legislate for a national foundation curriculum for pupils of compulsory school age in England and Wales. The aim is to equip every pupil with the knowledge, skills, understanding and aptitudes to meet the responsibilities of adult life and employment. Within the secular national curriculum, the Government intends to establish essential foundation subjects - maths, English, science, foreign languages, history, geography, technology in its various aspects, music, art and physical education. The degree of definition and the requirements to be set for each of these subjects will of course vary widely, but maths, English and science are at the centre of the curriculum and working groups are therefore being established first in these subjects. The Secretary of State for Wales will be considering what particular provision will be needed to accommodate the distinctive needs of the Welsh curriculum.

1.2 For most foundation subjects, the Government wishes to establish clear objectives - attainment targets - for the knowledge, skills, understanding and aptitudes which pupils of different abilities and maturity should be expected to have acquired at or near certain ages. To promote these objectives, the Government wishes to establish programmes of study for the subjects, describing the essential content which needs to be covered to enable pupils to reach or surpass the attainment targets. Taken together, the attainment targets and programmes of study will provide the basis for assessing pupils' performance - in relation both to expected attainment, and to the next steps needed for the pupils' development.

1.3 The Government wants attainment targets and the content of what is taught to reflect current best practice and achievement.
Both the objectives (attainment targets) and means of achieving them (programmes of study) should leave scope for teachers to use their professional talents and skills to develop schemes of work, within a set framework which is known to all. It is the task of the subject working groups to advise on that framework. The assessment instruments used, including tests, will be developed separately in the light of the working group's recommendations and those of the TGAT (see 3g below). This group will report by Christmas and I will then invite the Working Group to reflect its findings in their work.

2. The Task

2.1 Against this background, the mathematics/science working group is first to submit an interim report to the Secretary of State by 30 November 1987 outlining:

a) the contribution of mathematics/science to the overall school curriculum which will inform their thinking about attainment targets and programmes of study;

b) their provisional thinking about the knowledge, skills, understanding and aptitudes which pupils of different abilities and maturity should be expected to have attained and be able to demonstrate at or around the end of the academic year in which they reach the ages of (7), 11, 14 and 16. (The working group may recommend that a different age than 7 should be used to check progress in attainment during the first years of primary education, but some checking before the age of 11 is required);

c) provisional thinking about the programme of study through from 5 to 16 which would be consistent with the attainment targets provisionally identified.

2.2 In the light of this thinking, the working group should also make initial recommendations in their interim report about assessment of performance related to the attainment targets, and in particular what might appropriately be measured.
by externally set tests rather than by other techniques of assessment.

2.3 By 30 June 1988, the working group is to submit a final report to the Secretary of State, setting out and justifying its final recommendations on attainment targets and the programme of study for mathematics/science.

3. APPROACH

3.1 Working groups will be given an indication of approximately how much time they should assume to be available within the curriculum for mathematics/science. This time will also be intended to cover the teaching of cross-curricular themes to which mathematics/science can contribute. The working group should consult informally with relevant interests and have regard to the work of the other subject working groups. Additionally it should take account of:

a) best practice and the results of relevant research and curriculum developments;

b) the national and subject criteria for GCSE, taken together with recent work to establish a more objective approach to measuring attainment through the GCSE, which should provide the starting point for recommendations relating to attainment at age 16 and programmes of study for ages 14-16;

c) the need for continuity and progression throughout compulsory schooling;

d) the contribution which mathematics/science can make to learning about other subjects and the contributions which these subjects can make to learning about mathematics science;

e) the need for attainment targets and programmes of study to reflect cross-curricular themes and subjects;
f) the need to devise attainment targets and programmes of study appropriate for pupils of different abilities. The working group should give particular thought to the application of attainment targets in mathematics/science to lower attaining pupils; and,

g) the work of the Task Group on Assessment and Testing which the Secretary of State is setting up to make early recommendations on common criteria for the assessment framework and the choice of techniques of assessment.
The purpose of this letter is to offer more detailed guidance about your task than is contained within your terms of reference.

Attainment Targets

2. By "attainment targets" I have in mind clearly specified objectives for what pupils should know, understand and be able to do at or around the end of the academic year in which they reach the ages of 7 - or thereabouts - 11, 14 and 16. It is essential that attainment targets provide specific enough objectives for pupils, teachers, parents and others to have a clear idea of what is expected and to provide a sound basis for assessment and testing. The working group may recommend that a different age than 7 should be used to check progress in attainment during the early years of primary education, but some checking before the age of 11 is required.

Programmes of Study

3. I am expecting the programme of study to provide a detailed description of the content, skills and processes which all pupils need to be taught so that they can develop the knowledge and understanding they will need to progress through school and eventually to adult life and employment. This detailed description needs to be set within an outline or overall map of the science curriculum which takes account of what may be expected of pupils of different abilities. The degree of definition in the requirements set will vary considerably between foundation subjects, but will be greatest for the three core subjects of which science is one.

4. Within the overall programme of study, the Government's intention is that there must be space to accommodate the enterprise of teachers, offering them sufficient flexibility in the choice of content to adapt what they teach to the needs of the individual pupil.
5. I expect that the development of attainment targets and programmes of study will be an iterative process. Some consideration of content is likely to come into your thinking about attainment targets. And before you are able to define attainment targets with the degree of specificity required, you will probably wish to stand back and consider objectives and the contribution of science to the overall school curriculum in more general terms. The precise way in which you arrive at your conclusions is for you to determine but I would stress again the importance of specificity in the definition of attainment targets.

Differentiation

6. I am looking to you to recommend attainment targets which set out the knowledge, skills and understanding which pupils of different abilities should be able to achieve by the end of the school year in which they reach one of the key ages. They should allow scope for the very able, those of average ability, and the less able to show what they can do. So far as possible I want to avoid having different attainment targets for children of different levels of ability. I shall expect you to justify any essential exceptions from this principle. In general I seek targets for each of the key ages which may be attempted and assessed at a range of levels, and which challenge each child to do the best that he or she can.

7. Attainment targets should reflect current best practice and achievement. They should be sufficiently challenging at all levels to raise expectations, particularly of pupils of middling achievement, as well as stretching and stimulating the most able. I hope that you will give particular thought to the application of attainment targets to lower attaining pupils.

Special needs

8. The Government propose that where a pupil has a statement of special needs under the 1981 Education Act, the statement should specify any national curriculum requirements which should not apply to that individual pupil. In addition, the holder of my office will be empowered to define in regulations circumstances in which the application of the national curriculum provisions to individual pupils might be modified for any foundation subject. For example, the modern languages regulations might indicate that pupils with severe difficulties in English should be introduced to a foreign language later than or on a different basis from most children. I should be grateful if you would consider whether any comparable modifications of the regulations could be justified in the case of science.

Assessment and Examinations

9. Attainment targets will provide objectives against which pupils' progress and performance can be assessed. The main purpose of such assessment will be to show what a pupil has learnt and mastered, so as to enable teachers and parents to ensure that he or she is making adequate progress and to inform decisions about the next steps.

10. I envisage that much of the assessment at ages 7 (or thereabouts), 11 and 14 will be school-based. It will be done by teachers as an integral part of normal classroom work. But in addition there will be nationally prescribed tests done by all pupils to supplement the individual teachers' assessments. Teachers will administer and mark these, but their marking - and their assessments overall - will be externally moderated.
11. I have established a Task Group on Assessment and Testing (TGAT) to advise on the practical considerations which should govern all testing and assessment including the basis for marking and recording of results. The terms of reference of TGAT are attached to this letter. TGAT is to report as early as possible in the New Year. In the light of its recommendations, the Government will commission various organisations to develop and pilot assessment instruments.

12. The main focus of your work will be on attainment targets and the programme of study. However, in your interim report I expect you to offer advice in broad terms about assessment in relation to the attainment targets you have in mind, particularly what might appropriately be measured by nationally prescribed tests. In preparing your interim report, you will need to consult TGAT which will be developing its general advice about assessment in parallel with your thinking about the assessment of science. In your final report, I shall expect you to offer advice, again in broad terms, about the other techniques of assessment for which you see a place. In so advising, you will need to take account of the assessment strategy which I shall be proposing in the light of advice from TGAT. I shall offer further guidance to you on this in the New Year.

GCSE

13. In defining attainment targets and the programme of study for 16 year olds, I suggest that you take as your starting point the GCSE National Criteria, including the draft criteria for "The Sciences: Double Award", currently the subject of consultation. You should not regard yourselves as bound by these, however, in particular, they may not be sufficiently specific for your purposes as regards objectives and/or content. You will want to take note of the SEC's work on making GCSE grades more objective: the reports of the relevant grade criteria working parties may be a source of ideas, and the SEC's further development work with respect to individual GCSE science syllabuses should make a useful contribution to your group's deliberations.

14. The Government expects that all pupils will take GCSE examinations in science or equivalent examinations approved against relevant GCSE criteria. It does not, therefore, anticipate the need for alternative assessment arrangements in science. But the Government expects that, within a common GCSE framework for science, differentiation of papers will be needed to cover the full ability range. We will look, in due course, to the newly formed School Examinations and Assessment Council (SEAC) to advise on whether, and if so how, the GCSE criteria need to be revised to reflect the national curriculum attainment targets and programme of study for ages 14-16, and to approve syllabuses accordingly.

TVEI

15. The TVEI pilot projects are providing valuable experience in identifying the most effective ways in which the education of 14-18 year olds can be made more relevant to the demands of employment and adult life. From September 1987, authorities are progressively involved in extending the TVEI pilots into a national scheme. The objective will be to give young people aged 14-18 in all maintained schools and colleges access to a wider and richer curriculum based on the lessons emerging from the pilot TVEI projects. In drawing up their plans, LEAs are required to reflect the Government's policy for the school curriculum in England and Wales as summarised in the curricular criteria based on "Better Schools", and issued by the DES in July 1986.

16. Authorities will want to use TVEI to build on the framework offered by the national curriculum and to take forward its objectives. The Government intends that the legislation should leave full scope for schools to determine how teaching is organised.
and the teaching approaches used so that the curriculum is delivered in the best way suited to their pupils. This flexibility should enable schools to accommodate any special emphasis within their TVEI plans, while still meeting the requirements of the national curriculum. You will wish to consider developments so far under TVEI so that they inform your deliberations.

General Principles

17. Generally in framing your recommendations, I expect you to consider the need for

- continuity and progression throughout the period of compulsory schooling and beyond
- breadth and balance
- relevance: the content and teaching of the various elements of the national curriculum should bring out their relevance to and links with pupils' own experience and background and their practical application and continuing value to adult and working life
- all elements of the curriculum to contribute to the development of general personal qualities and competencies in young people which will be of value to them in adult and working life - for example, self-reliance and self-discipline, a spirit of enterprise, a sense of social responsibility, the ability to work harmoniously with others, an ability to apply knowledge and use it to solve practical real life problems.

It will also be important to bear in mind that the curriculum should provide equal opportunities for boys and girls; and to consider, in this context, the expectations and attitudes of girls to science. You should also take account of the ethnic and cultural diversity of the school population and society at large.

Wales

18. You will need to bear in mind that your recommendations will relate to the whole of England and Wales and should allow enough flexibility for schools to give weight, where appropriate, to local circumstances. There will be arrangements in Wales for separate consideration of, and consultations about, the group's report. These will take account of any particular Welsh needs.

Resources

19. An increased emphasis on science and on practical science for all has implications for teacher time, for equipment and for accommodation but the Government expects the national curriculum and associated assessment to be developed and implemented broadly within the planned level of resources. In particular, the Government's expenditure plans provide for a further improvement in the overall pupil teacher ratio to 17:1 by 1990. It will be for authorities and schools to ensure that staffing resources as well as annual spending on support services, books and equipment and accommodation are directed to support the national curriculum.

20. For its part, the Government will give priority to support of the national curriculum in allocating resources for Education Support Grants and LEA Training Grants. This will build on existing support for new developments through these grants, for example
ESG funding for primary science and technology and the LEA Training Grants for retraining teachers in the shortage disciplines including science.

21. The Government aim to make the first sets of Orders, relating to attainment targets and programmes of study for science and mathematics, early in the first half of 1989 following wide consultation through the proposed National Curriculum Council. On this timetable, schools may expect to begin implementing these first Orders at the start of the academic year 1989-90. I shall look to you for advice on whether the Orders relating to science should be brought in on a phased basis rather than for all children in both primary and secondary schools at once.

Ages and Stages; Time Allocations

22. You should assume that all pupils other than those with statements of special need under the Education Act 1981 which specify otherwise will study science throughout their compulsory schooling and take a GCSE examination in science or equivalent examinations approved against relevant GCSE criteria.

23. Science and technology are not in practice taught as separate subjects in primary schools and it would not be sensible to try to do so. In view of this, I want you to look jointly at primary science and technology. To enable you to do this, I propose to appoint 3 or 4 additional members with knowledge of and expertise in primary technology.

24. In framing your recommendations you should assume that on average some 12.5% of the total curriculum time is available for combined science and technology in the primary phase. You should assume that between 10% and 15% of the total curriculum time is available for science for secondary pupils in years 1-3 and between 10% and 20% in years 4-5.

25. The range of times suggested for science in the secondary phase is intended to allow schools a measure of flexibility. In the fourth and fifth years we think the majority of pupils, and especially those capable of studying one or more of the separate sciences beyond age 16, should take a balanced science course, occupying no more than 20% of curricular time, leading to a double GCSE award. But you will also need to consider the needs of a minority of pupils for whom a single GCSE award in the sciences may be more appropriate. I look to you to advise on the circumstances in which pupils should be steered towards a single award rather than a double award course. The Government's general policy on secondary science remains that set out in "Science 5-16: A Statement of Policy", namely that science courses covering selectively and in a coordinated way the essential elements of all three sciences are preferable at this stage to study of the sciences as separate subjects.

Links with other subjects

26. "Science 5-16: A Policy Statement" said that primary teachers should link work in science with the development of the language and mathematical competence of their pupils and with the practical component of the curriculum more generally; while secondary teachers should work closely with their colleagues in mathematics, CDT and home economics departments; and more widely so that the contribution which other subjects can make to the teaching of science and vice versa is fully exploited.

In framing your recommendations I hope you will take account of these possibilities. You will need to give particular thought to the links between science and technology. Under the Government's proposals, technology is a foundation subject and a technology working group will be set up within the next 6-9 months to develop attainment targets and a programme of study for the secondary phase, linking with the emerging thinking of your group.
27. There are a number of important subjects, themes and skills which can be taught and developed through the foundation subjects. I look to you to consider the place of such aspects within the science curriculum and to cover them within your consideration of attainment targets and programmes of study. All subjects should promote the development of good written and spoken English and numeracy. In the case of science I would expect you to cover the scientific aspects of health and safety education (excluding sex education) and the practical use and application of computers and Information Technology in control, simulation, data storage and retrieval. Subjects such as astronomy and earth sciences may provide suitable contexts in which important scientific concepts can be developed. Beyond this, "Science 5-16: A Policy Statement" suggested how science might contribute, for example, alongside other foundation subjects, to

- the development of personal qualities and values such as curiosity, healthy scepticism, respect for the environment and for the care of living things
- awareness of industrial applications of science and uses and misuses of energy.

You may have further suggestions. Time for covering these aspects within science will need to be found within the overall time available for science as indicated in paragraph 24 above.

Conclusion

28. Generally in carrying forward your work you should take "Science 5-16: A Statement of Policy" as your policy framework. In particular you will find it helpful to follow the 10 principles set out in paragraph 13; and the guidance on the content and objectives of primary science (paras 24-27) and on a broad science curriculum for all secondary pupils (paras 69-85). You may also find it useful to take account of good practice in those LEAs that have developed effective and well-founded policies for science. I hope that you will draw on the collective wisdom and experience of professional bodies such as the Association for Science Education.

29. I look forward to receiving, by 30 November 1987, your interim report covering the ground indicated in paragraphs 2.1 and 2.2 of your outline terms of reference as elaborated in this letter. Your final report should be with me no later than 30 June 1988 and earlier if possible.
Theme 1: Living Things and Their Interaction with the Environment

1.1 The diversity of life

The diversity of life illustrated by considering the range of organisms in a range of habitats, including an accessible habitat to develop further the concept of biological classification.

**Attainment target**

In the context of observing a wide range of organisms from a variety of habitats, pupils should understand that:

- organisms can be grouped into sets and sub-sets on the basis of a number of common characteristics; these groupings are given particular names (e.g., Alga, Moss, Fern, Mollusc, Vertebrate, Mammal, Bird)

Pupils should be able to:

- assign an organism to its major group on the basis of observable features

1.2 The relationship between organisms, habitat and the environment to develop the concept of adaptation.

Through experiences (for example field visits, film, slides, video) of a range of habitats both in the UK and globally pupils can develop ideas about the ways in which living organisms are adapted to enable them to live in a habitat successfully and that these adaptations can be structural and/or behavioural.
Attainment target
In the context of the study of a variety of habitats, pupils should understand that:
- the habitat must provide an organism with its basic needs if it is to complete its life cycle successfully
- structural and/or behavioural adaptations enable an organism to live successfully in its habitat
Pupils should be able to
- suggest an appropriate habitat for an organism on the basis of observable features

3 Plant nutrition and its role in sustaining life
Through investigations of the role of light in photosynthesis and the products of this process, pupils have opportunities to develop their understanding of plant nutrition and its role in sustaining life.

Attainment target
In the context of simple laboratory investigations on plants pupils should understand that:
- photosynthesis is the process whereby plants make food using light energy
- oxygen is produced when plants photosynthesise

1.4 Ecosystems including energy flow to develop the concept of the food chain. Experience of constructing food chains can be given through a consideration of the interdependence of organisms in particular familiar habitats.

Attainment target
In the context of working on food chains pupils should understand that
- animals ultimately depend on plants
1.5 The organisation of living things and the processes which characterise them to develop the concept of organ system function. Through the study and investigation of their own bodies, pupils further develop their knowledge and understanding of how the main organ systems involved with digestion, circulation, respiration, excretion, movement and coordination function.

**Attainment target**

In the context of investigating the human body pupils should understand the basic functions of the main organ systems and how they work together in a healthy person.

Pupils should be able to:

- make simple metabolic measurements on themselves.

6 Scientific aspects of human health and well being to develop the concepts of immediate and long term effects. Through investigations, discussions and a consideration of relevant information pupils develop their understanding of, and attitudes towards, the care of their teeth, personal hygiene, smoking, and the effects of diet and exercise on the circulatory system and their general well being.

**Attainment target**

In the context of investigating and analysing health related information pupils should understand that:

- the way they are looking after themselves at the moment has long-term effects, some of which could be harmful.

7 Reproduction, development and growth in human beings to explore concepts associated with the biology of human reproduction and sexuality. Through the study of how human being reproduce pupils further develop their knowledge and understanding of human reproduction, their physical and emotional development during adolescence, and the responsibilities human beings have to each other.
Attainment target
In the context of studying how human beings reproduce pupils should understand
- the pattern of human development through adolescence and the basic biology of human reproduction
Pupils should be able to
- identify the main organs in the human female and male reproductive systems and understand their basic function.

THEME 2: MATERIALS AND THEIR CHARACTERISTICS

2.1 The diversity of natural and manufactured materials illustrated by considering their uses as they relate to properties and availability
Investigations on a variety of different substances give pupils opportunities to describe with increasing accuracy their appearance and behaviour in terms of the following properties - tensile and compressive strength; stiffness and flexibility; hardness and softness; elasticity and plasticity; density; melting point; solubility in water; chemical reactivity - and the way these properties influence the everyday uses to which materials can be put.

Attainment target
In the context of common solid materials in everyday use, pupils should understand that
- the properties of materials influence the uses to which they are put
Pupils should be able to
- carry out investigations and tests on materials and artefacts in order to relate properties to uses

2.2 Different classifications of substances including states of matter; metals/non-metals; acids, bases and salts
Pupils are given opportunities to extend their understanding of the properties of substances through making observations on solids, liquids and gases and
through investigations into ways of separating mixtures. Simple investigations involving acids, alkalis and indicators and studies of the destructive properties of metals and non-metals introduce them to ways in which substances can be classified in terms of their chemical properties.

**Attainment target**

In the context of commonly encountered substances, pupils should understand that:
- mixtures can be separated into components
- how the physical properties of substances relate to systems of classification and methods of separation

Pupils should be able to
- use appropriate techniques for separating mixtures and investigating the properties of materials

2.3 The process of changing substances by chemical reaction

Laboratory experiments involving neutralisation reactions and the formation of oxides by heating elements in air provide an introduction to the idea of chemical reactions.

**Attainment target**

In the context of familiar, everyday substances, pupils should understand that:
- acids and alkalis neutralise one another
- when some elements are heated in air they form their oxides

Pupils should be able to
- carry out safely simple test-tube experiments involving the handling of dilute acids and alkalis and the heating of materials
Investigations on the macroscopic properties and the behaviour of materials, including changes of state and solubility in a variety of contexts, provide opportunities for pupils to reflect on how their observations could be explained in terms of ideas about the constitution of matter.

**Attainment target**

In the context of everyday examples of changes of state and solubility, pupils should be able to:

- articulate their own ideas about the constitution of matter, relating these ideas to a range of phenomena.

2.5 The manufacture of materials from available resources taking account of social, economic and environmental factors.

Investigations of ways in which useful materials can be made from raw materials (e.g., the fractionation of petroleum and the extraction of a metal from its ore) can be undertaken in the laboratory and used as a basis for considering certain industrial processes.

**Attainment target**

In the context of industrial processes such as the refining of petroleum and the extraction of metals from their ores, pupils should understand that:

- the laboratory processes studied can be used as a basis for industrial processes which convert raw materials into useful products.
HEME 3: ENERGY AND MATTER

1. Energy associated with changes of temperature and state and macroscopic properties of materials.

Pupils can investigate a range of materials and their interaction with different forms of energy. Such investigations can enable them to choose materials suitable, for example, heat/sound insulation, electrical conductivity/insulation, light protection and collision protection.

Attainment target:

In the context of everyday examples of changes of state (for example, weather, earth sciences, home economics and everyday materials)

pupils should understand that

- materials are chosen for particular purposes because of their behaviour towards heat, light, sound, electricity
- energy changes are associated with transformations of state and with changes within a particular state (for example, expansion)

Pupils should be able to

- suggest appropriate methods for comparing the suitability of different materials for certain practical uses (for example, electrical conductors, sound insulation, structural materials)

Energy in action: The formation of new substances, current electricity, electro-magnetic radiation and sound

Laboratory investigations of fuels, simple electrical circuits, the sources and receptors of sound and the simple properties of light, can be carried out in order to provide pupils with basic knowledge of the phenomena.
Attainment target
In the context of the use of energy in the human body and in everyday situations pupils should understand
- the nature of fuels
- the flow and effects of an electric current: heating, magnetic, chemical
- the simple properties of light
- sources, transmission and reception of sound

Pupils should be able to
- construct a simple circuit from a given circuit diagram to investigate a problem
- compare the properties of different fuels

3.3 Forms, transfer, transformation, degradation and conservation of energy
Pupils understanding of these aspects of energy can be developed through a consideration of a wider range of energy transformations in everyday as well as laboratory contexts; surveys of domestic energy sources and energy-saving measures; analysis of their own and others' diets in terms of energy inputs and requirements.

Attainment target
In the context of the human body, of simple devices which pupils encounter in their everyday lives and of the domestic environment, pupils should understand that
- energy can be thought of as existing in a number of forms: it can be transferred from one place to another and can be transformed
- heat is a 'by-product' of all energy transformations

Pupils should be able to
- analyse the energy content of human diets and evaluate them in relation to varied human energy requirements
- undertake a simple survey of domestic energy use and consider ways of avoiding energy 'waste'.
3.4 Global energy resources

Up to the age of 14, this topic may be studied in the context of other aspects of energy, leading to the attainment target below.

**Attainment target**

In the context of the study of energy in 3.1, 3.2 and 3.3, pupils should be aware that
- there is a range of domestic energy sources
- global energy resources are limited
- energy sources may be renewable or non-renewable

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**THEME 4: FORCES AND THEIR EFFECTS**

4.1 Forces and their effects on movement

Pupils can investigate everyday instances of motion, both practically and by analysis of data.

**Attainment target**

In the context of everyday examples of motion, such as transport and sport, pupils should be able to
- make appropriate measurements involving time, speed and distance travelled, represent them graphically and use them to make calculations and comparisons.
- make appropriate measurements etc etc

4.2 Forces and their effect on matter and structures

(Aspects of relevance at this age range are addressed within Theme 2.1)
4.3 Electric and magnetic forces and fields
Pupils can investigate the properties of permanent magnets and electromagnets, and relate them to their applications. They can investigate basic electrostatic phenomena recognising examples in everyday experience. Pupils can construct electromagnets and investigate the interaction between electric currents and magnetic fields in the context of making model devices and the application of the principles in everyday life.

**Attainment target:**
In the context of everyday applications and examples, pupils should be able to
- describe the behaviour and properties of magnets and electromagnets and the factors involved in the operation of simple electromagnetic devices;
- know about some electrostatic phenomena and understand them in terms of opposed charges
- use simple techniques for exploring magnetic fields
- use appropriate materials in the construction of model electromagnetic devices

4.4 Forces and machines
Pupils should investigate how problems may be solved using simple machines and tools.

**Attainment target:**
In the context of problem-solving activities with simple machines pupils should be able to
- evaluate the effectiveness of such devices for carrying out practical tasks
Appendix E

Purposes and Principles

1. The basis of the national assessment system should be essentially formative, but designed also to indicate where there is need for more detailed diagnostic assessment. At age 16, however, it should incorporate assessment with summative functions. (Paragraph 27)

2. All assessment information about an individual should be treated as confidential and thus confined to those who need to know in order to help that pupil. (Paragraph 28)

3. For summative and evaluative purposes results should be aggregated across classes or schools so that no individual performances can be separated out. (Paragraph 29)

4. Assessment of attitudes should not form a prescribed part of the national assessment system. (Paragraph 30)

5. To realise the formative purpose of the national assessment system, pupil results in a subject should be presented as an attainment profile. (Paragraph 33)

6. An individual subject should report a small number (preferably no more than four and never more than six) of profile components reflecting the variety of knowledge, skills and understanding to which the subject gives rise. Wherever possible, one or more components should have more general application across the curriculum: for these a single common specification should be adopted in each of the subjects concerned. (Paragraph 35)

7. The national system should employ tests for which a wide range of modes of presentation, operation and response should be used so that each may be valid in relation to the attainment targets assessed. These particular tests should be called “standard assessment tasks” and they should be so designed that flexibility of form and use is allowed wherever this can be consistent with national comparability of results. (Paragraph 50)

8. Assessment tasks should be reviewed regularly for evidence of bias, particularly in respect of gender and race. (Paragraph 52)

9. Attainment targets should be exemplified as far as possible using specimen tasks. Such tasks can then assist in the communication of these targets. (Paragraph 56)

10. A mixture of standardised assessment instruments including tests, practical tasks and observations should be used in the national assessment system in order to minimise curriculum distortion. (Paragraph 59)
Teaching and APs' ratings of pupil performance should be used as a fundamental element of the national assessment system. Just as with the national tests or tasks, teachers' own ratings should be derived from a variety of methods of evoking and assessing pupils' responses. (Paragraph 60)

When the subject working groups provide guidance on the aggregation of targets into a small number of profile components, they should have regard to the need for each component to lead to a report in which reasonable confidence is possible. (Paragraph 61)

Teachers' ratings should be moderated in such a way as to convey and to inform national standards. (Paragraph 62)

The national assessment system should be based on a combination of moderated teachers' ratings and standardised assessment tasks. (Paragraph 63)

Group moderation should be an integral part of the national assessment system. It should be used to produce the agreed combination of moderated teachers' ratings and the results of the national tests. (Paragraph 77)

An item bank of further assessment instruments should be available for teachers to use in cases where they need additional evidence about particular pupils. (Paragraph 78)

The final reports on individual pupils to their parents should be the responsibility of the teacher, supported by standardised assessment tasks and group moderation. (Paragraph 80)

Wherever schools use national assessment results in reports for evaluative purposes, they should report the distribution of pupil achievements. (Paragraph 84)

The assessment system in practice

The ages for national assessment should be 7, 11, 14 and 16, with reporting occurring near the end of the school year in which each cohort reaches the age involved. (Paragraph 92)

Each of the subject working groups should define a sequence of levels in each of its profile components, related to broad criteria for progression in that component. For a profile component which applies over the full age-range 7 to 16, there should be ten such levels, with corresponding reduction for profile components which will apply over a smaller span of school years. (Paragraph 101)
21. Levels 1 to 3 should be used for national assessments at age 7 (Paragraph 103)

22. The formal relationship between national assessment and GCSE should be limited, in the first instance, to this one reference point; and accordingly the boundary between levels 6 and 7 should correspond to the grade F/G boundary for GCSE. (Paragraph 105)

23. As they develop the upper four levels of their profile components, the subject working groups should adopt present practices for determining GCSE grades at A/B, C/D, mid-E, and F/G as a starting point. (Paragraph 106)

24. GCSE should be retained in its present form until the national assessment system is initiated at earlier ages. (Paragraph 107)

25. Assessment and reporting for the national assessment system should be at the same ages for all pupils, and differentiation should be based on the use of the single sequence of levels set up to cover progression over the full age range. (Paragraph 112)

26. Support items, procedures and training should be provided to help teachers relate their own assessments to the targets and assessment criteria of the national curriculum. (Paragraph 116)

27. A review should be made of the materials available to schools for detailed diagnostic investigation of pupils' learning problems, and that the need for extra help with production or advice about such materials should be considered. (Paragraph 117)

28. A working group should be established, with some shared membership between the subject working groups, to co-ordinate their proposals for assessment, including testing, at the primary stages, in the light of a comprehensive view of the primary curriculum and of the need to limit the assessment burden on teachers. (Paragraph 123)

29. National assessment results for any individual pupil should be confidential, to be discussed between pupil, parents and teachers, and to be otherwise transmitted in confidence. National assessment results for a class as a whole and a school as a whole should be available to the parents of its pupils. (Paragraph 131)

30. The only form in which results of national assessment for, and identifying, a given school should be published should be as part of a broader report by that school of its work as a whole. (Paragraph 132)

31. Any report by a school which includes national assessment results should include a general report for the area, prepared by the local authority, to indicate the nature of socio-economic and other influences
which are known to affect schools. This report should give a general
indication of the known effects of such influences on performance.
(Paragraph 134)

32. National assessment results, for pupils at age 11, aggregated at
school level, should be published as part of each primary school’s report.
There should be no requirement to publish results for pupils at age 7
(Paragraph 137)

33. National assessment results for pupils at ages 14 and 16, aggregated
at school level, should be published as part of each school’s report.
(Paragraph 138)

34. At age 7 the standard assessment tasks for the national assessment
should comprise a choice of three prescribed tasks for each child; each
task should be designed to give opportunities for systematic assessment
of competence in the range of profile components appropriate to age 7.

35. At age 11 the tests for national assessment should include three or
four standard tasks which cover a range of profile components, possibly
supplemented by more narrowly focused tests for particular
components. (Paragraph 153)

36. Records of Achievement should be used as a vehicle for recording
progress and achievement within the national assessment system.
(Paragraph 162)

37. Eventually changes will be necessary to the GCSE and other criteria.
Changes derived from the development of the national curriculum
should have priority in an orderly process of amendment.
(Paragraph 163)

38. Like all children, those with special educational needs require
attainable targets to encourage their development and promote their
self-esteem. Wherever children with special educational needs are
capable of undertaking the national tests, they should be encouraged to
do so. (Paragraph 169)

39. A special unit within a chosen test development agency should be
dedicated to producing test materials and devising testing and
assessment procedures sufficiently wide-ranging and sensitive to
respond to the needs of these children. (Paragraph 169)

Implementation

40. Each subject working group should decide on a limited number,
usually four, of profile components in relation to which any pupil’s
performance will be assessed and discussed. A criterion-referenced set of levels should be set out for each component, to span the full range of performance over the ages for which the component is applicable. (Paragraph 178)

41. Subject working groups should specify, in broad terms and for each profile component, the appropriate tests (standardised assessment tasks) which should be prepared, and the advice and help which should be given to teachers about their corresponding internal assessments. (Paragraph 183)

42. Combination of profile component levels to give a subject level should be by a specified procedure. Uniform ways of describing profile components and the level within each should be specified in language that is helpful to pupils, teachers, parents, employers and other users. (Paragraph 186)

43. Subject working groups should give general advice about the degree of novelty of the assessments they envisage, so that the construction of them and the provision of in-service support for teachers can be appraised. (Paragraph 188)

44. The new assessment system should be phased in over a period adequate for the preparation and trial of new assessment methods, for teacher preparation, and for pupils to benefit from extensive experience of the new curriculum. This period needs to be at least five years from the promulgation of the relevant attainment targets. (Paragraph 199)
Objectives at Age 11

Skills in the Science Method

Pupils should be able to:

(a) make recommendations including measurements of objects and phenomena, recognising similarities and differences;

(b) sort their observations into related groups or patterns;

(c) make predictions based on observed patterns;

(d) suggest reasons for the patterns identified from observations;

(e) carry out fair tests for explanations whilst using apparatus safely and confidently;

(f) record and interpret observations in a variety of ways;

(g) check data collected and modify experiments in the light of findings;

(h) draw upon their previous experience of science when approaching a new investigation.

Scientific Knowledge and Understanding

(a) materials and their characteristics:

matter exists in three states which have distinctive properties;

(i) some solids dissolve in water and some do not;

(ii) materials of the same shapes and sizes have different masses;

(iii) some solids float and some sink.

(b) forces and their effect:

(i) forces are pushes or pulls which may cause movement and are involved in such phenomena as weight and magnetism;

(ii) the effect of a force depends on the area of application;

(iii) the strength of an object or structure is determined in part by the material of which it is made.
(c) energy and its interaction with materials:
   (i) energy exists in a variety of forms such as heat, light and electricity;
   (ii) energy can be stored (for example - batteries and fuels);

(d) living things and their interaction with the environment:
   (i) living things are interdependent and there is a relationship between the populations of various species;
   (ii) the life cycle of any living thing is repeated, producing organisms of the same species each generation;
   (iii) green plants, water and oxygen have a crucial role in life processes associated with ecosystems;
   (iv) human beings hear, see, feel, and taste.

(e) change and control:
   (i) living things change as they grow older, some gradually and others completely changing forms;
   (ii) changes can be reversible or irreversible, and accelerated or altered by man;
   (iii) there are cyclical changes in nature.

Objectives at Age 16

Skills in the Science Method

Pupils should be able to:

(a) select, and interpret observations in a variety of contexts, making precise measurements where appropriate;

(b) process observations, for the formulation of generalisations;

(c) make predictions based on observations, knowledge and understanding;

(d) formulate hypotheses from observations and predictions;

(e) design and conduct an investigation with attention to dependent and independent variables within the constraints of the safe and efficient use of apparatus;

(f) represent their experimental findings and other data using graphs, tables, charts, symbols and conventions choosing the most appropriate form;
rank hypotheses in order of plausibility; assess the worth of data collected or presented; reformulate hypotheses, problems or investigations as necessary; 

bring knowledge and understanding to bear in new situations and in solving technological problems.

Scientific Knowledge and Understanding

(a) materials and their characteristics:

(i) the particular nature of matter to explain diffusion and changes of state on transfer of heat energy;
(ii) the classification of materials into elements, mixtures and compounds and the arrangement of particles in these;
(iii) the classification of particles into atoms, molecules and ions;
(iv) chemical change;
(v) the structure of the atom and its relationship with radio activity.

(b) forces and their effects:

(i) how forces can cause a change of motion or shape;
(ii) the relationship between force and turning;
(iii) pressure as force acting on unit area;
(iv) force and acceleration;
(v) friction;
(vi) the interaction of magnetic and electromagnetic forces.

(c) energy and its interaction with materials:

(i) energy and its transformation give rise to a variety of phenomena which affect the environment;
(ii) energy is conserved in a closed system and transfer can be quantified;
(iii) each transformation dissipates energy, usually as heat;
(iv) a consideration of the following energy forms electrical, sound, light, heat, nuclear, chemical, kinetic and potential.
(d) living things and their interaction with the environment:

(i) the form, function and mode of life of living things are influenced by environmental conditions;

(ii) the cell is a basic unit of most living things, which may consist of one or many cells which are adapted to their function;

(iii) the sun as the primary energy source linked with food chains;

(iv) the function of cells in reproduction and growth and including the function of genes and chromosomes.

(e) change and control:

(i) evolution can describe long term processes in living things;

(ii) chemical and other changes are influenced by conditions such as temperature, concentration, and catalysis, and can be controlled by feedback mechanisms;

(iii) chemical and physical changes are accompanied by variations in energy.