SPECIALIST SCIENCE SCHOOLS

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Executive Summary

In the fifth of our series of reports on the decline of school physics, we focus on the specialist science schools. They were designated, together with schools in other specialisms, in what became more of a general school improvement programme than an attempt to enhance particular subjects. Science schools have, however, been given the lead role in attempting to revive physics at GCSE as part of triple science.

We pose two core questions: (1) do science schools increase participation in physics; and (2) are they improving performance in physics? These questions are addressed through national datasets for the years 2002-03 to 2006-07, and also a survey conducted in the summer term 2008.

Characteristics of Specialist Schools

- Secondary maintained schools in England in 2007 fell into three broad groupings: 'academic' specialisms (science, maths & computing, languages, humanities and music); 'practical' specialisms (performing arts, technology, engineering, business & enterprise, and sports); and non-specialist.
- Grammar schools were more likely to adopt academic specialisms (69.5% against 29.6%) and non-selective schools practical specialisms (57.2% against 28.7%). 13.1% of non-selective schools compared with 1.8% of grammar schools remained without a specialism in January 2008.
- Non-selective schools with academic specialisms tended to have intakes of higher prior attainment, lower eligibility for free school meals, and fewer special needs whether statemented or supported.
- Non-selective schools with academic specialisms were often voluntary aided, foundation, single sex, or faith schools, but no more likely than those with practical specialisms to have sixth forms.
- Non-selective schools with academic specialisms achieved better Key Stage 3 and GCSE results than those with practical specialisms, but there was no difference in contextual value added from Key Stage 2 to GCSE.

GCSE Physics

- 70% of specialist science schools provided GCSE physics in 2007 (now a requirement), up from 43% in 2003.
- GCSE physics percentage entry and results were similar in science schools to other academic specialisms, but above practical specialisms.
- Non-selective schools with more than five entries in GCSE physics tended to be those with intakes which had higher prior attainment, lower eligibility for free school meals and fewer special needs.
- On average, 46% of Year 11 pupils in grammar schools took GCSE physics in 2007 compared with 17.5% in non-selective schools.

- Whether or not a school offered GCSE physics could be predicted with 72% accuracy from whether it was a science school (5.6 times more likely), grammar school (4.6 times more likely) and a boys' school (twice as likely).

- GCSE physics entries in non-selective schools correlated most with Key Stage 3 science score (entitlement is based on Level 6 in Key Stage 3 science) and percentage of boys.

- GCSE physics performance was strongly related to prior attainment (Key Stage 2 scores and Key Stage 3 science scores), but unlike take-up there was no association with gender.

A-Level Physics

- In 2007, physics came 11th in a listing of the 28 most frequently taken A-levels, behind even psychology, sports studies, design & technology, and expressive arts.

- Three-quarters of the specialist schools with sixth forms had at least three A-level physics entries in 2007, 98.2% of grammars (two girls' grammars did not) and 71.7% of non-selective schools.

- 86.1% of non-selective science schools provided A-level physics, similar to most other academic specialisms, but above the practical specialisms.

- In 2007, on average 23.7% of A-level physics entries in non-selective science schools obtained an A grade compared with 36.0% in music schools, 26.5% in languages schools, and 24.4% in maths & computing schools, but significantly above sports (18.2%), technology (17.3%), business & enterprise (17.2%) and engineering schools (13.0%).

- There was no correlation between GCSE and A-level physics provision, allowing for specialism.

- A-level physics performance correlated with GCSE physics performance, controlling for selection and specialism.

- In regression analysis, the best predictor of A-level physics performance was general GCSE performance.

Non-Specialist Schools

- Comprehensive schools without specialisms tended to be those not meeting the standards for specialist status, scoring lower on intake and performance measures, and having distinctive characteristics.

- Specialist schools were found to add more value than non-specialist schools, but since adding value is part of the approval process they would have been the more effective in the first place.

- The longer a school had been specialist the more value it appears to add, but this was attributed to successive creaming off from a diminishing residual pool.

Choice of Specialism

- The main reason given for choosing a particular specialism, including by the science schools, was strength in the subject.
- For science schools, the second most common reason was weakness in the subject, with specialist status being seen as a lever for improvement.
- The third reason was direction by local authority or the Specialist Schools and Academies Trust to arrive at a range of specialisms in the locality.
- Schools with other specialisms gave as their second reason: supporting the whole curriculum, through for example the performing arts, technology or sport.
- The main benefit of specialist status, irrespective of specialism, was perceived to be extra funding.
- Science schools also saw specialist status as a way of attracting science teachers.
- Science schools were less likely than other specialist schools to mention as potential benefits: catalysing good practice; improving IT provision; raising school morale; improving performance outside the subject; or better CPD.

Conclusions

Our interpretation is that the specialist schools policy has proved useful as a general programme for freshening up a tired comprehensive system. But it has created a mix of schools with names that do not seem to mean very much.

Whether as the government seeks to use specialist status to drive policies such triple science and diplomas, the schools will become more differentiated along specialist lines remains to be seen.

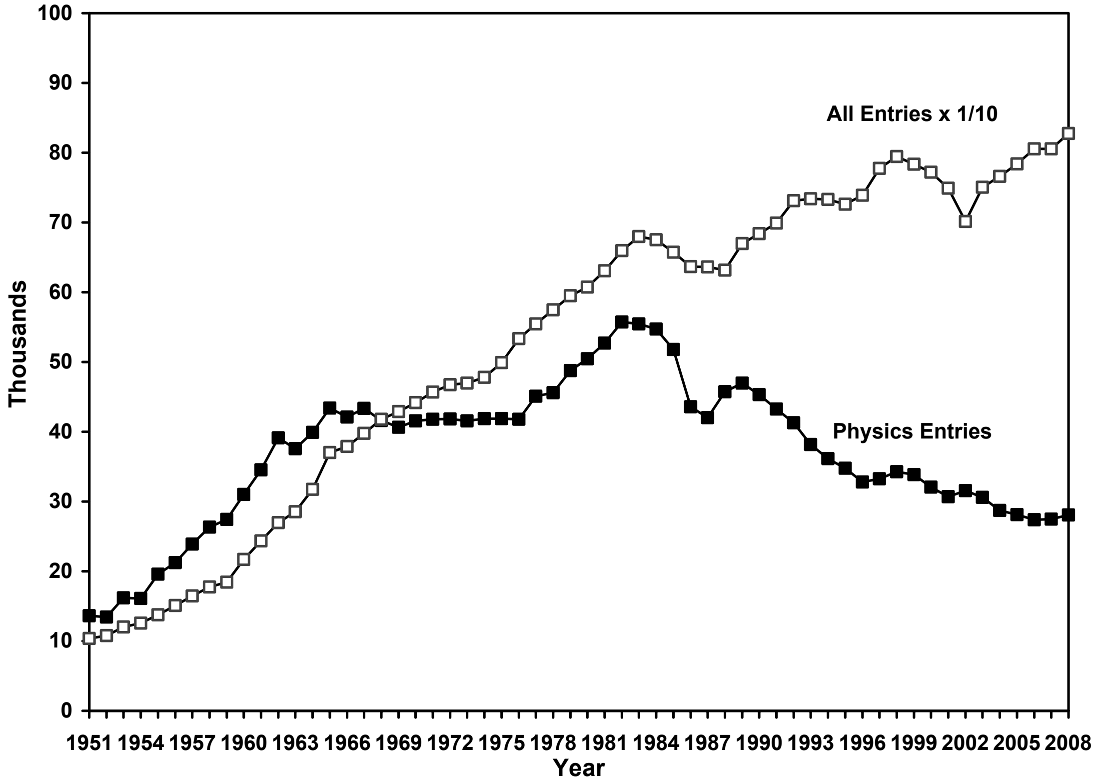
Science schools are like schools with other academic specialisms in intake, characteristics and performance, but different from those with practical specialisms. They are not distinctively scientific. For a science school to become truly a science school, or a sports school truly a sports school, it would have to be able identify, admit and develop particular talents. But this would mean selection at age 11, defined even more narrowly than under the grammar school system.

It is an urgent problem for government to find ways of bringing together what is now a diverse collection of schools into a secondary education system with shape and coherence.

1. Introduction

1.1 Physics in schools and universities has been in sharp decline. Chart 1.1 shows that entries at A-level have plummeted at a time when A-level entries overall have risen. Since 1990, physics entries, based on the annual returns of what is now the Joint Council for Qualifications, went down from 45,300 to 28,100 (38.0 per cent decrease), while total entries went up from 684,100 to 827,700 (21.0 per cent increase). The fall in A-level physics entries has impacted on the universities where 17 physics departments closed between 1994 and 2004 (Smithers and Robinson, 2006).

Chart 1.1: A-Level Physics Entries Compared to All Entries

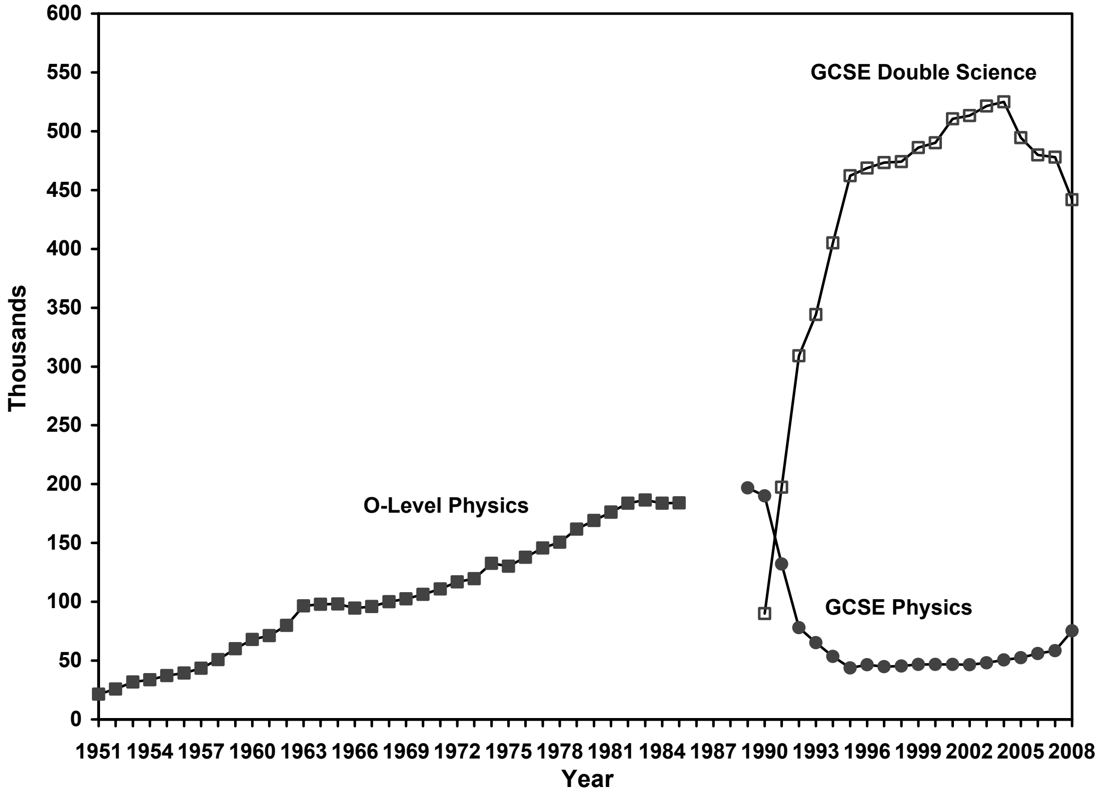


Sources: 1951-77, *Education in England and Wales, Report and Statistics*; 1978-85, *Statistics of Education School Leavers GCE and GCSE England*; 1985-present *Inter-Board Statistics Advanced Level for England, Wales and Northern Ireland.*

1.2 The retreat from A-level physics has coincided with the national curriculum's inception in 1988 and a change in the qualifications at age 16. Prior to the national curriculum many pupils, especially girls, wrote themselves off from all the sciences at age 14. In order to counteract this and also achieve a better gender balance, science became a required subject to the age of 16. It was given the time allocation of two subjects and the three main sciences were brought together as combined science. A double award science GCSE was developed to accommodate the change. It was originally intended that physics, chemistry and biology GCSEs would be phased out, but this was fought by the independent schools, which were not bound by the national curriculum. Some state schools, particularly grammar schools, also wanted to teach the individual sciences and it was eventually agreed that they could do if they followed the national curriculum and entered the pupils for all three at the same time (independent schools retained the right to enter pupils for any combination or none as they wished).

1.3 Chart 1.2 records the massive change that ensued in the pattern of entries at GCSE. Entries for physics dropped from 190,000 in 1990 to 43,800 in 1995 before recovering to 75,400 in 2008. In contrast, the number of pupils entered for double award science rocketed from 89,900 in 1990 to 525,000 in 2005, since when it has fallen back to 441,900. The CBI (2008) has calculated that the individual sciences are currently taken by just seven per cent of 16-year-olds.

Chart 1.2: Trends in O-Level/GCSE Physics



Sources: 1951-77, *Education in England and Wales, Report and Statistics*; 1978-85, *Statistics of Education School Leavers GCE and GCSE England*; 1989-present *Inter-Board Statistics GCSE* for *England, Wales and Northern Ireland*.

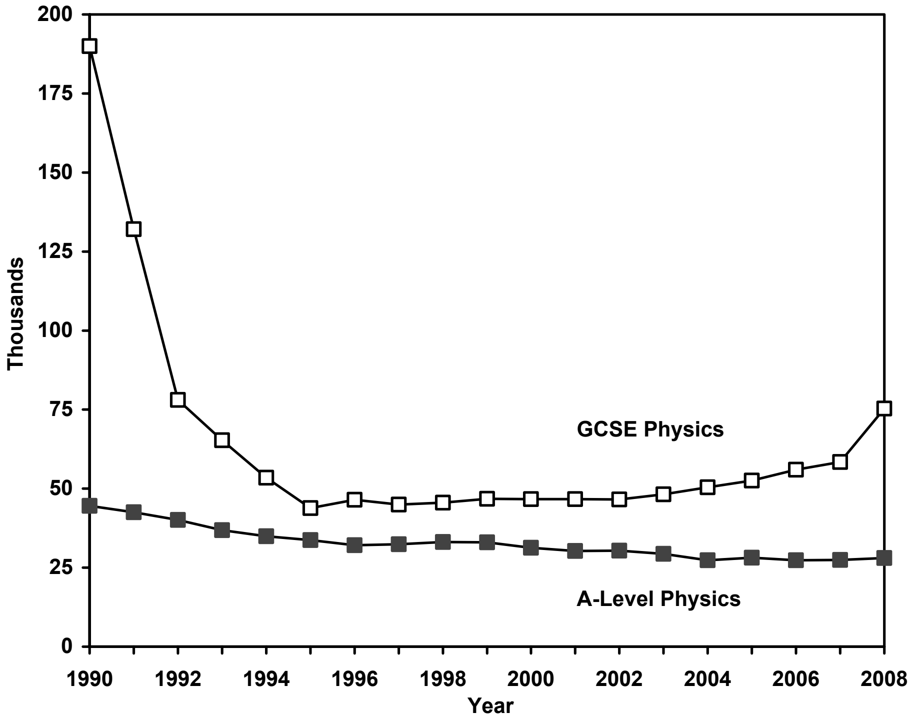
1.4 The government has noted that the decline in A-level physics occurred at the same time as the switch from GCSE physics to the science GCSE and has assumed some connection. In March 2006 it published a *Science and Innovation Investment Framework 2004-2014: Next Steps* (HM Treasury, 2006) which signalled a drive to return to the individual sciences. It made the following commitments:

- "by September 2008, all pupils achieving at least level 6 at Key Stage 3, to be entitled to study triple science GCSE, for example through collaborative arrangements with other schools, FE colleges and universities;

- by September 2008, ensure that all specialist science schools offer triple science at least to all pupils achieving level 6+ at the end of Key Stage 3; and
- encourage all schools to make triple science available to all pupils who could benefit."

Those commitments have been overtaken by the decision to abolish the compulsory national tests at the end of Key Stage 3 (DCSF, 2008c), but it is likely that they will be re-framed in terms of classroom assessment by teachers.

Chart 1.3 GCSE and A-Level Physics Entries[1]



1. GCSE and A-level entries from maintained schools, independent schools, sixth form colleges, tertiary colleges and FE colleges in England, Wales and Northern Ireland compiled from the Inter-Board Statistics.

1.5 In Chart 1.3 we display the trends in both GCSE and A-level physics. Bearing in mind that A-level entries could be expected to have some relation to GCSE entries two years earlier, the steep fall in GCSE physics from 1990 to 1995 is echoed by a drop in A-level entries from 1992 to 1997. But since 1998 A-level entries have continued to drift downwards at a time when GCSE physics entries have been recovering. We do not yet know what the effects of the sharp increase in GCSE physics entries in 2008 might be. Thus although there is a correlation between the switch from GCSE physics and the decline at A-level, we cannot be sure that there is causation. Other factors could be mainly responsible for the observed pattern, for example, poor teaching, inadequate curricula and syllabuses, performance pressures on schools, or a general lack of interest.

Specialist Schools

1.6 In a parallel development at first unconnected with any concern about the decline in A-level physics, the government has been designating schools as having subject specialisms. But since 2006 science schools[1] have come to be at the forefront of the policy to restore GCSE physics in schools. In this report we investigate what has prompted schools to choose particular specialisms and what contribution they are making in their nominated subjects. In particular, it has as its core questions: (1) are science schools increasing participation in physics at GCSE and A-level; and (2) are they improving performance in physics at GCSE and A-level? But first let us look to see how it is that we come to have specialist secondary schools.

City Technology Colleges

1.7 The specialist schools programme, it is fair to say, was not planned but has happened. It had its origins in Kenneth Baker's desire, when he became Education Secretary in 1986, to improve state education. He was, however, unwilling "to entrust any initiative to the reactionary local education authorities" (Baker, 1993). He envisaged a new type of school, the city technology college (CTC) that would revitalise education in rundown city areas, give more autonomy to headteachers, and involve employers in both funding and governance. To get the scheme off the ground sponsors were needed. It was at first envisaged that they would pay about £2 million to meet all the capital costs of the new schools - £1 million to purchase redundant schools from local authorities and £1 million for refurbishment and equipment. To take the programme forward Baker set up the City Technology Colleges Trust supported by government money and he appointed Cyril Taylor as its head.

1.8 A number of interested industrialists and business leaders came forward including some who are commemorated in the names of the schools which they helped to found, Harry Djanogly in Nottingham, Philip Harris in South London and Stanley Kalms of Dixons in Bradford. But the programme hit a major snag. A number of local authorities obstinately refused to sell off redundant or closing schools. This meant that the city technology colleges had to be built from scratch and the cost escalated tenfold, out of reach of even the most enthusiastic supporters. So the government had to meet the main part of the costs, both capital and recurrent. In a further departure, because Conservative local authorities were more likely to co-operate by providing sites, the schools tended to be built in leafy suburbs like Solihull rather than the inner city areas as intended. Fifteen city technology colleges were eventually opened before the government decided to call a halt. These included a performing arts city technology college in Croydon sponsored by the British Record Industry Trust.

Technology Schools

1.9 There the initiative might have ended if it had not been for another problem the government of the day faced, coupled with the energy and ambition of Cyril Taylor. In the Education Reform Act of 1988 the new compulsory subject of technology had been framed. This involved welding together craft, design and

[1] Some specialist schools prefer to be called 'colleges' but we have used 'school' throughout to be clear that our focus is secondary schools rather than further education colleges.

technology (itself a portmanteau subject), home economics, business studies, art and design, and information technology (later budded off to leave two subjects: design and technology, and information and communications technology). As could have been anticipated, this ran into major difficulties, but of more concern to the government than the infighting was that it could not afford to equip all schools at the same time to the standard necessary to mount the subject (Smithers and Robinson, 1997).

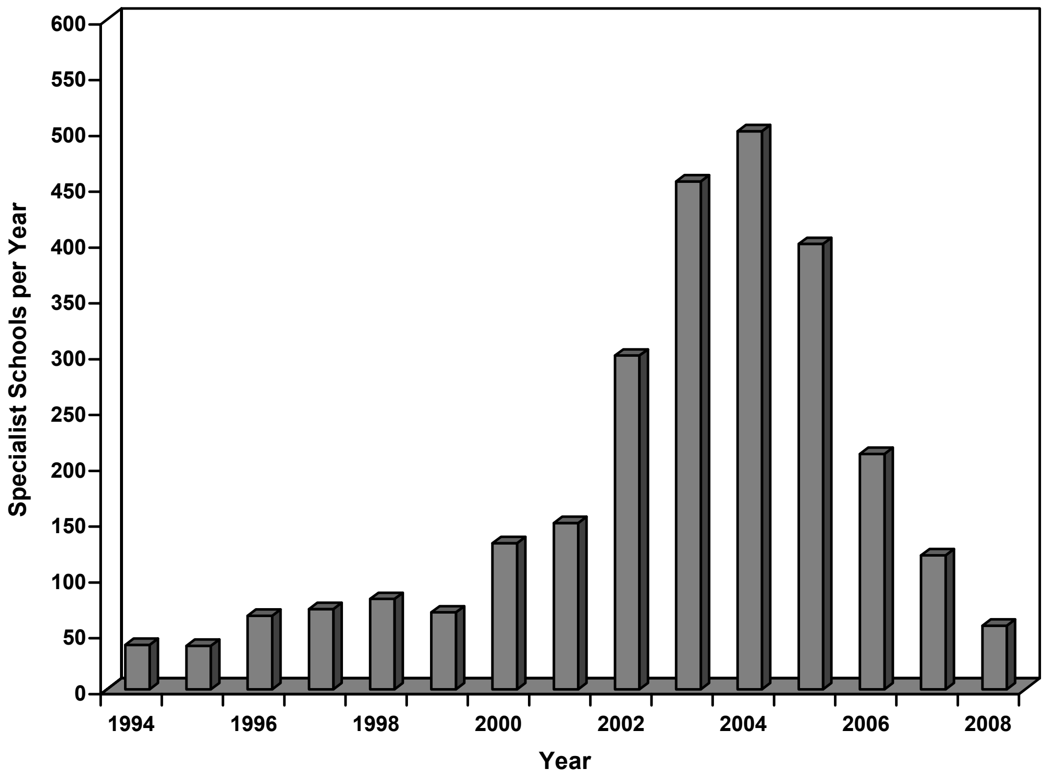
1.10 At this point Cyril Taylor came up with the idea which gave rise eventually to specialist schools (Taylor and Ryan, 2005). Why not turn existing schools into technology schools, he argued. This would both rescue the apparent failure of the city technology college initiative and enable to government to roll out funding for technology over an extended period. After two years of the Technology Schools Initiative, which was essentially about a capital development grant, the Technology Colleges Programme was launched in 1993. Originally it was limited to voluntary aided and grant maintained schools, possibly to encourage more schools to opt out of local authority control, but following representations the scheme was opened up to all secondary maintained schools in the November budget statement of 1994. The first technology colleges formed from existing schools opened in 1994 (all grant maintained and voluntary aided). In 1995 the model was extended to include modern foreign languages as a specialism, and sport and performing arts were added in 1997. The City Technology Colleges Trust became the Technology Colleges Trust.

Specialist Schools

1.11 When Tony Blair came to power in 1997, 222 technology schools (not including the city technology colleges) had been designated. It would not have been surprising if the incoming Labour government had wound up this embryonic Conservative initiative. But urged on by Sir Cyril Taylor (first knighted in 1989), supported by data from his Trust apparently showing that technology status improved performance, specialist status became adopted as Labour policy. It was, however, an unfair comparison since the first technology schools were highly selected and poorly performing schools have always been debarred. Nevertheless, a target was set for 450 more schools to achieve specialist status by the end of the parliament. By Blair's second term specialist schools had become the cornerstone of his policy for diversity in secondary education. The target was first raised to 1,500 then 2,000, and eventually it became envisaged that all secondary schools would have a specialism. In 2003, the Technology Schools Trust became the Specialist Schools Trust.

1.12 Chart 1.4 shows the progress of the specialist schools policy year by year and Chart 1.5 the breakdown by sole or first specialism for schools extant in 2007. A few schools have changed from their original technology specialism to specialisms which became possible at later dates. Science, business & enterprise, maths & computing, and engineering were added in 2002; the possibility of combined specialisms was opened up in 2003, and humanities and music became options in 2004.

Chart 1.4: Specialist Schools by Year Operational



Source: www.standards.dcsf.gov.uk/specialist schools (accessed 2 April 2008).

Chart 1.5: Specialist Schools by Sole or First Specialism and Year First Designated[1]

Specialism	Year First Designated as Specialist School[2]															All
	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	
Technology	39	33	43	37	45	35	47	56	75	59	45	31	11	3	2	561
Languages		6	23	15	9	13	27	27	28	31	16	16	9	3	3	226
Sports				11	15	10	27	33	60	68	53	51	23	14	6	369
Performing Arts				6	12	10	25	33	80	57	83	79	40	24	11	460
Science				2			2		24	98	110	53	25	12	7	333
Business & Enterprise									17	65	66	56	31	16	6	257
Maths & Computing	1			1		1	2		12	64	79	55	35	14	9	273
Engineering							1		4	13	25	7	6	7	2	65
Humanities										1	17	42	25	25	9	119
Music											6	9	6	2	2	25
Total	40	39	66	72	81	69	131	149	299	455	500	399	211	120	57	2,688[2]

1. Schools listed by sole specialism or first specialism in a combination. Schools are entered under the date they were first designated, but some have changed their original specialisation so that there is a scattering of science and other schools apparently before the subject specialism became an option.

2. Out of a total of 3,073 state schools (87.5 per cent) with pupils up to the age of 16 (excluding city technology colleges and academies).

1.13 Subsequently, 'special needs' and 'applied learning' have been added as specialisms. Neither shows up in Chart 5.1, which tabulates the first specialism of those secondary schools that enter pupils for GCSE. The special needs specialism is mainly for special schools though a few do have it as a second specialism. 'Applied learning' is ancillary to the main specialism. In further elaborations of the policy specialist schools may be designated high performing specialist schools, training schools, and partnerships working together to raise achievement (DCSF, 2008b). By January 2008, 2,688 (87.5 per cent) of 3,073 state schools (excluding city technology colleges and academies) entering pupils for GCSEs had been designated with at least one out of the ten subject specialisms. All the schools in 25 local authorities had become specialist (DCSF, 2008a).

Academies

1.14 The Labour government not only carried forward and extended the technology schools programme, but also has revived the city technology college concept first as city academies then just academies. Sir Cyril Taylor, knighted again in 2004, acquired responsibility for these also and the Specialist Schools Trust became the Specialist Schools and Academies Trust. Academies, however, are another story.

School Specialisms

1.15 Although specialist schools are now an established part of the education landscape it is not clear in what sense they are specialist. Schools have been keen to become specialist because designation brings with it a substantial tranche of extra money. The idea of sponsorship has been preserved from the original criteria. In order to mount a bid schools are expected to raise £50,000 (originally £100,000) from outside sources. On having specialist status conferred, a 1000-pupil school, under current funding arrangements, will receive an extra £129,000 a year (enough for four extra teachers) plus a capital grant of £100,000. Specialist status is renewable every four years. As well as raising sponsorship the schools have to demonstrate how they are going to raise their performance overall, increase achievement in their specialism and work with partner schools and the community. Although nominally about particular subjects, the government came to see the specialist programme more as a general school improvement initiative (Education and Skills Select Committee, 2005).

1.16 The relation of a specialist school to its particular subject field is ambiguous. Most specialist schools are not able to select their intakes. Some comprehensives and secondary moderns that have become specialist are able to select up to 10 per cent of their intakes, but for others it is not permitted. The opportunity depends on whether the specialism is deemed to require aptitude or ability. 'Aptitudes' like technology and sport can be selected, but 'abilities' like science and maths cannot. Most grammar schools have become specialist. They are still able to select, but they do so on general ability rather than on a particular talent in, for example, science or languages. Since perhaps the most consistent result from educational research is that the major factor affecting a school's performance is the children who go to it, it is difficult to see what part sports schools, for example, can play in educating those who will represent the country in the future. The government would argue that this is not the prime purpose of these schools, which is to raise standards of attainment in physical education and sport for all students. But surely physical well-being is the responsibility of all schools and not just the sports schools. So what is it about them that merits the distinctive title?

1.17 We have seen that A-level and university entries in physics have declined steeply in recent years. Specialist science schools might be expected to make a major contribution towards reversing this trend. But they have to do so with a cross-section of abilities rather than selecting on interest and ability in the sciences. In the following chapters we explore who the specialist science schools are; how their educational performance in general compares with that of other specialist and non-specialist schools; and, crucially, whether proportionally more pupils in them study physics and do better at the subject.

Methods

1.18 Physics provision, participation and performance were examined mainly through compiling national school level datasets for the years 2002-03 to 2006-07. National Pupil Level Databases (made available to us by the Department for Children, Schools and Families) were aggregated to the school level. Additional variables were added from three further DCSF sources. Its 'Edubase' provided information on, for example, age range and gender, the School and College Attainment Tables gave the schools' examination results, and the date a specialist school became operational was obtained from the Standards website. Eligibility for free school meals was obtained under the Freedom of Information Act.

1.19 Analysis focused on the 1,643 schools that achieved specialist status, whether in science or another subject, between 2002 and 2005 (see Chart 1.5) and were extant in 2007. This period was chosen because 2002 was the first year from which it was possible to become a science school (the four apparently designated earlier had previously had technology as their specialism). A cut-off of 2005 was adopted because the latest examination results available at the time of the study were those published in August 2007, and it was thought that the effects of science status could not be expected to show through in less than two years. Mangan *et al* (2005) came to a similar view. Conveniently, as Chart 1.4 shows, 2002-2005 is the period when designations were at their height. Targeting specialist schools designated between 2002 and 2005 automatically excludes non-specialist schools from consideration. But this is an advantage because as weaker schools unable to achieve specialist status they can take attention away from comparisons between the specialist schools themselves. Comparisons between non-specialist schools and specialist schools treated as a group are, however, made later in the report (in Chapter 9).

1.20 As well as national datasets, the report is based on a survey conducted in the summer term of 2008 of (1) science schools and (2) a sample of schools with high science achievement that might have become science schools but opted for other specialisms. It was designed to find out what had led the schools to choose their particular specialisms and how they had benefited. In science, for example, was it that they were already strong in science and wanted to mark the fact, or that they were weak in science and thought specialist status would give it a boost, or were there other reasons? The survey also explored how the sciences, other subjects and the school in general had benefited.

The Report

1.21 We begin, in Chapter 2, by charting the progress of science schools towards the government's target that all schools with this specialism should offer physics as part of triple science provision from September 2008. We then compare science schools with other specialist schools to see if they too are reintroducing the separate sciences. Logistic regression has been used to uncover which school features are most likely to be associated with provision. GCSE physics can be on offer to pupils who have achieved well in science at Key Stage 3, but that does not mean it will necessarily be taken up. In Chapter 3 we compare the percentages of Year 11 pupils in the specialist schools offering GCSE physics and explore why they appear to fall into two main groups. In Chapter 4 we turn our attention from participation to performance and ask: which pupil and school characteristics are most closely associated with success in the subject?

1.22 In Chapters 5 to 7 the focus is on A-level physics. First, provision, exploring whether those schools offering GCSE physics are also more likely to have the A-level available. As with the GCSE, in Chapter 6 we analyse the extent to which the provision is taken up, before going on in Chapter 7 to consider performance. The three GCSE physics chapters and the three A-level physics chapters address the central questions of this inquiry. But it is not a matter of chance that some types of school are attracted to, or are awarded, particular specialisms. In Chapter 8, we report on the different types of specialist school in terms of intakes, school characteristics, and performance. The non-specialist schools consistently emerge as weaker than the specialist schools (which have had to measure up to performance and other criteria). In Chapter 9, we make a detailed comparison between the specialist schools treated as a group and those not yet designated. Completing our physics story we ask what is provision, participation and performance like in the non-specialist schools.

1.23 Not all schools strong in the sciences chose to become science specialist schools and not all science specialist schools had a good record in the sciences. In Chapter 10 we present an analysis of the responses of both science and other specialist schools to a questionnaire on choice of specialism and the perceived benefits of specialist status. In Chapter 11 we bring together the findings to ask: is school specialisation in science boosting take-up and achievement in physics? This is then broadened out to ask: what has the specialist schools policy achieved in the round? The main argument for the policy has been that the process leading to designation and becoming part of the family of specialist schools enables the schools to raise their game not only in their specialist subject but across the board. This has been justified by claims of appreciable differences in the performance of specialist schools and non-specialist schools. To what extent does this stand up, and what part, if any, is played by specialisation *per se*?

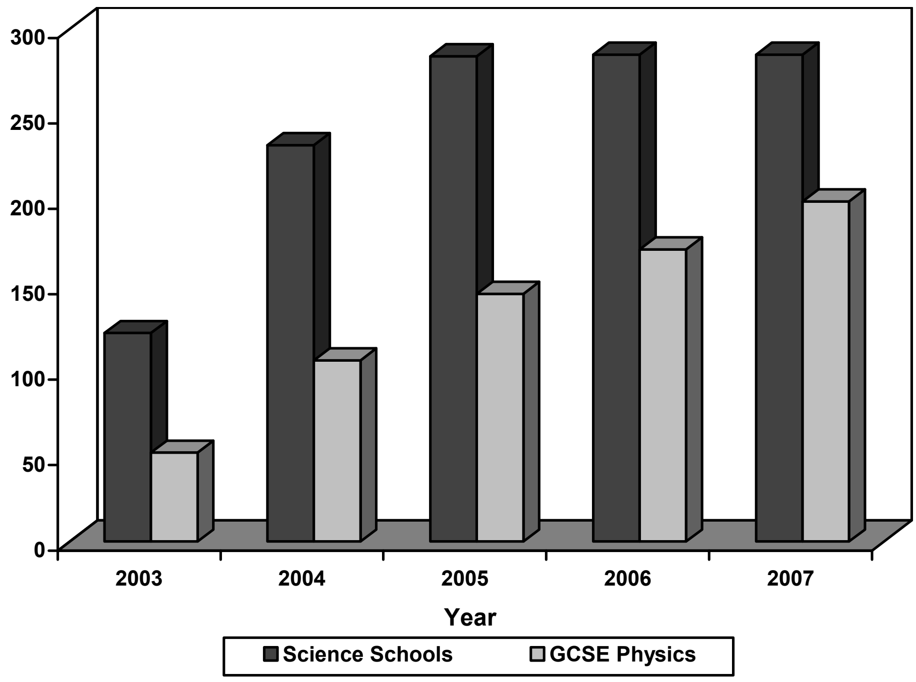
2. GCSE Physics Provision

2.1 In this and succeeding chapters we home in on the key question of this study: does being a specialist science school increase participation and improve performance in physics? Both GCSE and A-level are considered. Here we concentrate on GCSE provision and in the next two chapters we move on first to participation and then to performance.

2.2 Nearly all schools have the double award science GCSE and, as we have shown (Smithers and Robinson, 2007), physics can be taught well within it. But not all offer GCSE physics and it could at one time be taken as a barometer of the science orientation of a school. However, it has now been made obligatory for some schools. It has been become a requirement that all specialist science schools should, by September 2008, offer triple science, at least to all pupils who have achieved Level 6 in Key Stage 3 (HM Treasury, 2006). In science schools GCSE physics provision is, therefore, to some extent a matter of compliance rather than an individual decision.

2.3 Chart 2.1 traces the progress of the 285 science schools designated between 2002 and 2005 towards meeting the government's 2008 triple science target. GCSE physics provision was defined as having more than five entries in the examination in the particular year (some schools had just one or two candidates who might have been specially tutored). It shows that not only did the number of science schools go up, but also the proportion with more than five GCSE physics entries increased.

Chart 2.1: Specialist Science Schools[1] and Triple Science[2]



1. 285 schools designated science schools in the period 2002 to 2005.

2.Those offering GCSE physics and having more than five entries.

Source: National datasets compiled by CEER for each of the years shown (see Appendix A).

2.4 The actual numbers on which Chart 2.1 is based are given in Chart 2.2 which shows that overall the proportion of science schools with courses in GCSE physics increased from 43 per cent in 2003 to 70 per cent in 2007, as the number of science schools designated in the defined period rose from 122 to 285. Chart 2.2 also brings out the big difference between the grammar and non-selective schools, with the former being much more likely to offer GCSE physics. Since provision in the grammar schools was already high, the growth in availability of the subject at GCSE has been mainly in the non-selective science schools, rising from 37 per cent in 2003 to 67 per cent in 2007.

Chart 2.2: GCSE Physics[1] Provision in Specialist Science Schools[2]

Year	Non-Selective[3] Science Schools	Non-Selective[3] GCSE Physics	Non-Selective[3] %	Grammar Science Schools	Grammar GCSE Physics	Grammar %	All Schools Science Schools	All Schools GCSE Physics	All Schools %
2002-03	110	41	37.2	12	11	91.7	122	52	42.6
2003-04	203	85	41.9	29	21	72.4	232	106	45.6
2004-05	249	116	46.6	35	29	82.9	284	145	51.1
2005-06	250	142	56.8	35	29	82.9	285	171	60.0
2006-07	250	167	66.8	35	32	91.4	285	199	69.8

1. More than five entries.

2. Schools designated in the period 2002-2005

3. Comprehensive and secondary modern.

2.5 The difference between grammar and non-selective schools in this respect is not confined to science schools. Chart 2.3 shows the availability of GCSE physics in 2007 across all the specialisms.

Chart 2.3: GCSE Physics[1] in Selective and Non-Selective Schools 2007

Specialism[2]	Non-Selective[3] N	Non-Selective[3] GCSE Physics	Non-Selective[3] %	Grammar[4] N	Grammar[4] GCSE Physics	Grammar[4] %	Total Schools N	Total Schools GCSE Physics	Total Schools %
Science	250	167	66.8	35	32	91.4	285	199	69.8
Maths & Computing	191	60	31.4	19	11	57.9	210	71	33.8
Languages	73	18	24.7	18	13	72.2	91	31	34.1
Humanities	52	14	26.9	8	-	-	60	17	28.3
Music	10	5	50.0	5	4	80.0	15	9	60.0
Performing Arts	291	74	25.4	8	6	75.0	299	80	26.8
Technology	206	64	31.1	4	4	100.0	210	68	32.4
Engineering	43	21	48.8	6	4	66.7	49	25	51.0
Business & Enterprise	202	46	22.8	2	-	-	204	48	23.5
Sports	225	44	19.6	5	-	-	230	47	20.4
Total	1,543	513	33.2	110	82	74.5	1,653	595	36.0

1. More than five entries in GCSE physics.

2. Designated as sole specialism or first specialism in a combination.

3. Comprehensive and secondary modern.

4. Cells with three or fewer suppressed.

2.6 Overall, grammar schools were more than twice as likely to have the GCSE available in 2007 as non-selective schools - 75 against 33 per cent - with the difference more marked among specialisms other than science. It is notable that among non-selective schools the availability of GCSE physics is much lower in non-science schools, even in allied subjects such as maths & computing and technology. There are also hints of this among the grammar schools. It is evident that the triple science obligation on science schools has been having an impact.

2.7 In Chart 2.4 we ask to what extent is the growth in the availability of GCSE physics a general phenomenon. Since grammar schools are much more likely to offer GCSE physics the comparisons are confined to non-selective schools. There has been some growth from 2005 to 2007 in the proportion overall offering GCSE physics from 27 to 33 per cent, but this has been mainly driven by the science schools where the increase has been from 46 to 67 per cent, and also the engineering schools where it is has gone up from 28 to 49 per cent. The small group of music schools is distinctive, with half the non-selective schools offering GCSE physics, but without any increase over the three years. As we saw in Chart 2.3, four-fifths of the grammar music schools offered GCSE physics. This points to something that we will be exploring in detail in Chapter 3: schools differing in intake tend to opt for different subject specialisms. In the case of music schools, they tend to have high ability intakes, not just in music but generally.

Chart 2.4: GCSE Physics[1] in Non-Selective Schools[2] by Specialism

Specialism[3]	N	2005 GCSE Physics	2005 %	2006 GCSE Physics	2006 %	2007 GCSE Physics	2007 %
Science	250	116	46.4	142	56.8	167	66.8
Maths & Computing	191	56	29.3	58	30.4	60	31.4
Languages	73	15	20.5	18	24.7	18	24.7
Humanities	52	10	19.2	13	25.0	14	26.9
Music	10	5	50.0	5	50.0	5	50.0
Performing Arts	291	65	22.3	74	25.4	74	25.4
Technology	206	54	26.2	63	30.4	64	31.1
Engineering	43	12	27.9	17	39.5	21	48.8
Business & Enterprise	202	41	20.3	43	21.3	46	22.8
Sports	225	42	18.6	52	23.1	44	19.6
Total	1,543	416	26.9	485	31.4	513	33.2

1. More than five entries in GCSE physics.

2. Comprehensive and secondary modern.

3.Designated as sole specialism or first specialism in a combination.

2.8 It is clear that the availability of GCSE physics is strongly related to whether or not the school is a science school and/or a grammar school. This is borne out by the logistic regression of Chart 2.5 where the equation derived could predict with 72.4 per cent accuracy whether a school offered GCSE physics. There were three components to the equation: (1) being a science school (5.6 times more likely to teach GCSE physics than a school with another specialism); (2) being a grammar school (4.6 times more likely to have it available than a non-selective school); and (3) being a boys' school (nearly twice as likely to offer it as a girls' or mixed school).

Chart 2.5: Predicting[1] GCSE Physics[2] Provision

Variable	Odds Ratio	P<
Science School	5.56	0.001
Grammar School	4.56	0.001
Boys' School	1.97	0.004

1. Logistic regression of the 1,653 schools becoming operational as specialist schools between 2002 and 2005

2. More than five entries in GCSE physics.

2.9 These are not the only characteristics associated with a school offering GCSE physics. Provision also correlates with ability and other intake features, but these are bound up with, indeed can interfere with, the grammar school variable in logistic regression. In Chart 2.6 the importance of other variables is brought out in comparisons involving just the non-selective schools.

Chart 2.6: Mean Scores Non-Selective Schools Offering GCSE Physics

Variable	GCSE Physics Yes (N=513)	GCSE Physics No (N=1,030)	F	P<
Key Stage 2 Score	27.5	26.9	94.11	0.001
Key Stage 3 Score	34.9	33.8	92.95	0.001
Five Good GCSEs inc English and Maths	50.4	43.6	68.00	0.001
Contextual Value Added	1,000.2	1,002.2	5.64	0.05
% Eligible for FSM	11.6	15.9	44.63	0.001
% SEN Statemented	6.7	8.2	38.24	0.001
% SEN Supported	10.5	12.2	22.18	0.001

2.10 It shows that those schools with GCSE physics entries tend to take pupils with higher Key Stage 2 scores and to achieve better Key Stage 3 and GCSE results. They also tend to have fewer pupils eligible for free school meals, statemented with special needs or special needs supported. The only variable cutting across this pattern is contextual value added, where the schools not offering GCSE physics tended to add more value when background characteristics are taken into account.

2.11 Chart 2.7 similarly examines a number of categorical variables that might differ between schools with and without GCSE physics, again leaving the grammar schools to one side. The overall ratio in 2007 was about 1 to 2 (33.2 'with' to 66.8 per cent 'without'). The ratio is reversed in science schools where 66.8 per cent had entries in GCSE physics in 2007. Schools with sixth forms and faith schools differed from the overall picture. There are suggestions also that boys' schools and schools that control their own admissions are more likely to have GCSE physics available, but the differences barely reach statistical significance.

Chart 2.7: Percentages of Non-Selective Schools Offering GCSE Physics

Variable	GCSE Physics Yes (N=513) Variable		No (N=1,030) Variable		Chi-Squared	P<
	Yes	No	Yes	No		
Science School	66.8	33.2	26.8	73.2	151.30	0.001
Boys' School	44.4	55.6	32.8	67.2	3.71	0.06
Sixth Form	39.7	60.3	30.8	69.2	13.80	0.001
Faith School	38.6	61.4	32.1	67.9	4.13	0.05
Own Admissions	36.4	63.6	31.6	68.4	3.55	0.06

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2.12 The characteristics most closely associated with GCSE physics provision are whether or not the school is a science school (where it is now a requirement), a grammar school or a boys' school. Together they predicted with 72 per cent accuracy. By 2007, 69.8 per cent of the 285 science schools designated between 2002 and 2005 had more than five entries in GCSE physics. Triple science has not been provided in schools with other specialisms to the same extent. Even leaving aside the grammar schools, the GCSE-physics schools tended to be those taking more able, less disadvantaged pupils, and in charge of their own admissions.

3. GCSE Physics Participation

3.1 GCSE physics may be on offer, but this does not mean that pupils will take it. In this chapter, we focus on the percentages of exam entries. Among the science schools, grammar schools are not only more likely to offer GCSE physics, but also to have proportionately more of their Key Stage 4 pupils taking it. Chart 3.1 shows that the percentage entry in grammar schools has been consistently above 40 per cent compared with less than half that in non-selective schools. Take-up was highest in the first 41 science schools (non-selective and grammar), possibly because they had opted for the specialism from a position of strength. There has been some falling away as the number of science schools has expanded, but it has been relatively slight. The expansion in GCSE physics provision has, therefore, led to more pupils overall engaging with the subject in this way at this level.

Chart 3.1: Take-Up[1] of GCSE Physics in Science Schools[2]

Year	Non-Selective[3] Science Schools	Per Cent Year 11	Grammar Science Schools	Per Cent Year 11	All Schools Science Schools	Per Cent Year 11
2002-03	41	19.6	11	47.7	52	25.5
2003-04	85	17.4	21	44.1	106	22.7
2004-05	116	18.0	29	40.7	145	22.5
2005-06	142	18.2	29	41.2	171	22.1
2006-07	167	17.5	32	46.0	199	22.1

1. Mean percentage of Year 11 in those schools with more than five entries in GCSE Physics.
2. See Chart 2.2 for proportions of all science schools.
3. Comprehensive and secondary modern.

3.2 The differences in GCSE physics take-up between grammar and non-selective schools emerges even more strongly in schools with specialisms other than science. Chart 3.2 shows that, in 2007, percentage entry did not differ significantly across specialisms as far as the grammar schools were concerned. But, among the non-selective schools, science schools stood out, with the differences from performing arts, technology, engineering and sports schools being statistically significant beyond the five per cent level. Schools with other specialisms also had fewer entries, but not significantly so.

3.3 When the non-selective and grammar schools are taken together a clear split emerges between what might be called the 'academic' specialisms (science, maths & computing, languages, humanities and music) and the 'practical' specialisms (performing arts, technology, engineering, business & enterprise and sports). Grammar schools, not surprisingly, are concentrated in the academic specialisms, and their uneven spread across the fields and their very different characteristics from non-selective schools has led us to leave them aside from most of the analyses of this report.

Chart 3.2: Take-Up[1] of GCSE Physics in Specialist Schools[2]

Specialism[3]	Non-Selective[4]		Grammar		All Schools	
	N	%	N[5]	%	N	%
Science	167	17.5	32	46.0	199	22.1
Maths & Computing	60	15.2	11	56.4	71	21.6
Languages	18	13.8	13	40.7	31	25.1
Humanities	14	13.5	-		17	21.3
Music	5	16.6	4	40.5	9	27.2
Performing Arts	74	12.9*	6	64.8	80	16.8*
Technology	64	15.0*	4	22.5	68	15.4*
Engineering	21	11.4*	4	31.7	25	14.7*
Business & Enterprise	46	16.3	-	-	48	17.3
Sports	44	14.2*	-	-	47	16.4*
Total	513	15.3	82	46.2	595	19.6

1. Mean percentage of Year 11 in those schools with more than five entries in GCSE Physics.
2. See Chart 2.3 for proportions of all specialist schools.
3. Sole or first specialism in combination.
4. Comprehensive and secondary modern.
5. Cells with three entries or fewer suppressed.
*. Significantly different from science schools at the five per cent level.

3.4 Chart 3.3 sets out the growth in non-selective schools providing GCSE physics, alongside entries per school, from 2005 to 2007. Overall, entries have held up at around 15.5% of Year 11 even as the number of participating schools has increased.

Chart 3.3: Take-up[1] in Non-Selective Schools[2] by Specialism[3]

Specialism[4]	2005		2006		2007	
	N	%	N	%	N	%
Science	116	18.0	142	18.2	167	17.5
Maths & Computing	56	17.1	58	16.5	60	15.2
Languages	15	15.9	18	15.4	18	13.8
Humanities	10	11.8*	13	14.6	14	13.5
Music	5	16.8	5	18.4	5	16.6
Performing Arts	65	12.8*	74	13.2*	74	12.9*
Technology	54	14.1*	63	14.4*	64	15.0*
Engineering	12	10.8*	17	12.2*	21	11.4*
Business & Enterprise	41	13.4*	43	14.3*	46	16.3
Sports	42	15.8*	52	13.9*	44	14.2*
Total	416	15.5	485	15.5	513	15.3

1. Mean percentage of Year 11 in those schools with more than five entries in GCSE Physics.
2. Comprehensive and secondary modern.
3. See Chart 2.3 for proportions of all specialist schools.
4. Sole or first specialism in combination.
*. Significantly different from science schools at the five per cent level.

3.5 This also holds within specialisms. There are suggestions of a drop in entries in maths & computing and languages, and a rise in business & enterprise, but too slight to be definite trends. More striking than the changes over time are the within-year differences between specialisms. Take-up is highest in science schools, significantly above performing arts, technology, engineering and sports schools. Maths & computing and music come closest to the science schools.

3.6 The split between what we have called 'academic' and 'practical' specialisms is a recurring theme in this report. At root, it appears to stem from differences in intakes. We explore these in detail in Chapter 8, but as a taster we show by specialism in Chart 3.4 GCSE results, Key Stage 2 intake scores, Key Stage 3 scores and value added scores (Key Stage 2 to GCSE).

Chart 3.4: Attainment in Non-Selective Specialist Schools[1], 2007

Specialism[2]	% Five Good GSCEs inc Eng & Maths	Key Stage 2 Score	Key Stage 3 Score	Value Added KS2 to GCSE Score
Science	51.6	27.5	35.0	1,002.6
Maths & Computing	49.6	27.3	34.5	1,002.0
Languages	50.7	27.4	34.7	999.3
Humanities	49.5	27.4	34.5	1,004.5
Music	59.1	28.3*	36.2*	1,005.5
Performing Arts	45.2*	27.0*	34.0*	1,004.4
Technology	43.5*	27.0*	33.9*	997.5*
Engineering	39.5*	26.9*	33.6*	997.8
Business & Enterprise	43.6*	26.9*	33.7*	1,003.1
Sports	39.9*	26.7*	33.4*	999.8
Total	45.9	27.1	34.1	1,001.5

1. All non-selective specialist schools whether or not offering GCSE Physics (N=1,543).

2. Sole or first specialism in combination.

*. Significantly different from science schools at the five per cent level.

3.7 The patterns which emerge closely resemble those for the provision and take-up of GCSE physics. Science schools in the main differ significantly from the performing arts, technology, engineering, business & enterprise and sports schools on all three attainment measures. On the other hand, the 'academic' specialisms tended to be like the science schools. If anything the music schools tended to have even higher ability intakes and better GCSE performance. There were few differences in contextual value added between the school types with only the technology schools differing from the science schools (lower).

3.8 The pattern also emerges sharply when only those schools with at least five entries in GCSE physics are considered, as in Chart 3.5. Interestingly, these schools tended to have higher attainment levels than the generality of schools in Chart 3.4. The association between the availability of GCSE physics and pupil attainment is consistent with the grammar schools both being more likely to offer the subject at GCSE and having a higher proportion of their pupils take it.

Chart 3.5: Attainment in Specialist Schools[1] with GCSE Physics, 2007

Specialism[2]	% Five Good GSCEs inc Eng & Maths	Key Stage 2 Score	Key Stage 3 Score	Value Added KS2 to GCSE Score
Science	53.1	27.6	35.3	1,002.2
Maths & Computing	55.2	27.8	35.4	1,000.4
Languages	54.3	27.9	35.4	996.6
Humanities	51.9	27.6	34.8	1,002.6
Music	58.8	28.2	36.1	997.2
Performing Arts	49.1*	27.4	34.7*	999.8
Technology	47.1*	27.3*	34.5*	997.0*
Engineering	43.6*	27.2	34.2*	998.2
Business & Enterprise	49.5	27.3	34.6*	1,001.3
Sports	42.2*	27.1*	33.8*	998.2
Total	50.4	27.5	34.9	1,000.2

1. Non-selective specialist schools offering GCSE Physics (N=513).

2. Sole or first specialism in combination.

*. Significantly different from science schools at the five per cent level.

3.9 The link to ability also comes through strongly in regression analysis. Chart 3.6 presents the results of a backward linear regression on GCSE physics participation in the 513 non-selective schools with more than five entries in the subject. This sub-set is dominated by the science schools which comprise a third (167), but there is also strong representation from the performing arts (74), technology (64) and maths & computing schools (60).

Chart 3.6: Regression on GCSE Physics Take-Up[1]

Variable	Beta[2]	t	P<
Constant		-5.15	.001
Key Stage 3 Science Scores	.339	8.18	.001
% Girls End of Key Stage 4	-.112	-2.72	.01

1. In non-selective specialist schools with minimum of six pupils entered for GCSE physics.

2. The columns show the standardized regression coefficients, t scores and statistical significance. The higher the beta the better the prediction, the lower the probability the less likely this is to have been obtained by chance (0.05, one in twenty, is taken as the cut off point).

3.10 The variables entered included: intake characteristics such as Key Stage 2 results, eligibility for free schools meals and special needs; school characteristics such as specialism, year operational, admissions arrangements, age range, having a sixth form, gender; and performance variables such as Key Stage 3 science score and contextual value added. Two variables emerged as strongly related to physics take-up: the average Key Stage 3 science score and gender. The equation consisting of these and a constant accounted for 13.3 per cent of the variance in GCSE physics participation (R=.365).

3.11 It is plain to see why these two variables should stand out. The entitlement to study GCSE physics from September 2008 was for those who achieve a Level 6 in science at Key Stage 3, and in any case triple science is usually restricted to those who have shown real promise in the subject. The lack of affection girls have for physics is notorious and it follows that girls' schools and schools with a high proportion of girls are likely to have lower levels of entry.

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3.12 In those schools offering GCSE physics, take-up in grammar schools was more than twice that in non-selective schools - in 2007, 46 per cent of Year 11 against 17.5 per cent. The size of the entry from science specialist schools, both non-selective and grammar, fell slightly as triple science became a requirement. Among non-selective schools, there tended to be more entries from science, music, languages, maths & computing schools than from performing arts, technology, engineering, business & enterprise and sports schools. This mirrored the intake differences. Schools with higher ability intakes were more likely to offer and have more taking the GCSE. It is evident that the choice of specialism is not random. In regression analysis of non-selective schools, the two characteristics which emerged as most predictive of GCSE physics take-up, rather than being anything to do with specialism, were pupil characteristics - achievement in Key Stage 3 science and gender.

4. GCSE Physics Performance

4.1 We now turn from GCSE physics provision and entries to performance. Overall, there is a significant positive correlation between the size of the entry and the percentages achieving A*/A (+0.294, P<0.001, N=595). But this arises because the grammar schools have both bigger entries and better results. There is no significant correlation within either the non-selective or grammar school categories.

4.2 Chart 4.1 presents a time course of the results of science schools in GCSE physics from 2003 to 2007. There has been little consistent effect on performance as the number of schools offering the subject has expanded. Results improved in both non-selective schools and grammar schools from 2003 to 2004 when the number of science schools doubled from 52 to 106. But while results in grammar schools have gone up further since then, in the non-selective schools progress has been rather uneven. Taking both groups of schools together, there was a 3.4 per cent increase in A*/A grades from 2003 to 2007 which compares favourably with the figure for England as a whole of +2.8 percentage points. (Joint Council for Qualifications 2003 and 2007).

Chart 4.1: GCSE Physics Performance[1] in Science Schools

Year	Non-Selective[2] Science Schools	Non-Selective[2] Per Cent A*/A	Grammar Science Schools	Grammar Per Cent A*/A	All Schools Science Schools	All Schools Per Cent A*/A
2002-03	41	34.2	11	59.6	52	39.5
2003-04	85	39.1	21	63.5	106	44.0
2004-05	116	35.3	29	65.9	145	41.4
2005-06	142	39.3	29	69.0	171	44.4
2006-07	167	37.9	32	69.0	199	42.9

1. Mean percentage GCSE physics entries obtaining A* or A grade in those schools with more than five entries.

2. Comprehensive and secondary modern.

4.3 The 2007 GCSE physics performance of the science schools is compared with that of the other schools in Chart 4.2. Overall, the science schools come below the modern foreign languages schools, but above the technology, business & enterprise and sports schools. The outstanding performance of the languages schools stems from the presence of a high proportion of high achieving grammar schools among their total. The difference from the other three specialisms is due to the poorer performance of these non-selective schools and it reflects the intake differences shown in Chart 3.5, page 18. In the final column of Chart 4.2 the familiar split between academic and practical specialisms shows up, this time in respect of GCSE physics performance. The difference in intakes helps to explain what on the surface might appear to be the puzzling result that languages and music schools achieve better results in GCSE physics for larger numbers of pupils than do the engineering and technology schools.

Chart 4.2: GCSE Physics Performance[1], 2007

Specialism	Non-Selective		Grammar[2]		All Schools	
	N	% A*/A	N	% A*/A	N	% A*/A
Science	167	37.9	32	69.0	199	42.9
Maths & Computing	60	41.8	11	62.7	71	45.0
Languages	18	35.8	13	79.1	31	53.9*
Humanities	14	33.4	-	-	17	39.9
Music	5	34.7	4	77.6	9	53.8
Performing Arts	74	36.3	6	70.9	80	38.9
Technology	64	28.7*	4	54.8	68	30.2*
Engineering	21	31.1	4	72.9	25	37.8
Business & Enterprise	46	27.5*	-	-	48	28.2*
Sports	44	27.3*	-	-	47	28.3*
Total	513	34.6	82	68.4	595	39.3

1. Mean percentage GCSE physics entries obtaining A* or A grade in those schools with more than five entries in GCSE physics.

2. Cells with three entries or fewer suppressed.

*. Significantly different from science schools at the five per cent level.

4.4 Chart 4.3 looks at the 2007 results of non-selective schools in relation to those of 2005 and 2006. The overall percentage of A*/A grades remained steady across the three years at around 35.5 per cent as the number of specialist schools in the target population with GCSE physics entries increased from 416 to 513.

Chart 4.3: GCSE Physics Performance[1] in Non-Selective Schools[2]

Specialism[3]	2005		2006		2007	
	N	% A*/A	N	% A*/A	N	% A*/A
Science	116	35.3	142	39.3	167	37.9
Maths & Computing	56	37.4	58	37.7	60	41.8
Languages	15	45.6	18	35.5	18	35.8
Humanities	10	35.7	13	33.9	14	33.4
Music	5	45.2	5	38.2	5	34.7
Performing Arts	65	33.5	74	31.9*	74	36.3
Technology	54	32.5	63	30.7*	64	28.7*
Engineering	12	37.6	17	36.3	21	31.1
Business & Enterprise	41	27.6	43	30.2*	46	27.5*
Sports	42	28.4	52	29.6*	44	27.3*
Total	416	34.0	485	34.6	513	34.6

1. Mean percentage of Year 11 in those schools with more than five entries in GCSE Physics.

2. Comprehensive and secondary modern.

3. Sole or first specialism in combination.

*. Significantly different from science schools at the five per cent level.

4.5 Within the specialisms performance varied somewhat from year to year, with hints of falls and rises. The gap in the performance of the academic and practical specialisms opens up in 2006 with four differences from science schools significant that year compared with none the previous year.

4.6 The close relationship between GCSE physics performance and prior attainment comes through strongly in the regression analysis of non-selective schools in Chart 4.4. The analysis is of the same schools and the same variables as in the regression on take-up, but with the percentage of entries awarded A*/A grades now entered instead of percentage entries. The equation which emerged predicted 40.2 per cent of the variance (R=0.634). The main contributions come from attainment variables such as Key Stage 2 score and Key Stage 3 science score. The DCSF's measure of contextual value added from Key Stage 2 to GCSE also was implicated. General GCSE results were not included in this analysis because we were interested in antecedent rather than concomitant variables. But, as our checks showed, if it had been there GCSE performance would have dominated the equation. The value added measure seems to have been acting as its proxy.

Chart 4.4: Predicting GCSE Physics Performance[1]

Variable	Beta[2]	t	P<
Constant		-6.89	.001
Key Stage 3 Science Score	.353	5.09	.001
Key Stage 2 Scores	.225	3.33	.001
Contextual Value Added	.143	3.98	.001
Year Operational	-.106	-3.00	.005
Specialism	-.070	1.93	.054

1. In non-selective specialist schools with more than five pupils entered for GCSE physics.

2. The columns show the standardized regression coefficients, t scores and statistical significance. The higher the beta the better the prediction, the lower the probability the less likely is this is to have been obtained by chance (0.05, one in twenty, is taken as the cut off point).

4.7 There was also significant input from school characteristics. Year operational as a specialist school played a part, reflecting the fact that the higher performing schools tended to be accorded specialist status earlier. Specialism (scored from science to sport in the order of listing in the tables) also made a near significant appearance reinforcing the observation of Chart 4.3 that pupils in science schools and the other academic specialisms were more likely to get the better grades. However, unlike GCSE physics take-up there was no significant link with gender (r=-0.046, ns), consistent with girls who do get to take physics doing almost as well as the boys. (Physics is one of the very few GCSEs where boys do better than girls - 49.2 per cent against 46.6 per cent achieving A*/A grade in the 2007 examinations in England).

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4.8 There is a correlation overall between GCSE physics take-up and performance, since grammar schools have more entries and get better results. But within the non-selective and grammar sub-groups they are not linked significantly. Performance in science schools has held up as the number of courses and pupils have increased. Among non-selective schools in 2007, GCSE performance in science schools is similar to that of most other academic specialisms, but is significantly above that in technology, business & enterprise, and sports schools. This is consistent with differences in the intakes. Modern foreign languages schools have the best results for GCSE physics, but this reflects the high proportion of grammar schools in their number. In regression analysis, attainment variables such as average Key Stage 2 scores, Key 3 science scores, and contextual value added (standing as a proxy we think for general GCSE performance) make the major contributions. But year operational (strongest schools awarded status first) and specialism (ranked from science to sports) also play a part.

4.9 Thus the story that emerges for GCSE provision, participation and performance is that science schools are the most likely to offer GCSE physics, but take-up is linked to prior science attainment and gender, and performance mainly to other performance measures (Key Stage 2 and Key Stage 3 science) and some school characteristics (year operational and specialism).

5. A-Level Physics Provision

5.1 Moving on to A-levels, we again consider in turn provision, participation and performance. Of the 1,653 schools becoming specialist between 2002 and 2005, 978 were listed as taking students to age 18/19. But, of these some, had very few or no students beyond age 16/17. We, therefore, imposed a minimum of 20 students before counting the schools as having a sixth form. This eliminated 23 schools leaving 955 as the population for the A-level analysis. Of these, 110 were grammar schools, the same schools as in the GCSE analysis, since all grammar schools have sixth forms.

5.2 Chart 5.1 shows that these schools differed in the number of A-levels offered. Nearly three-quarters (72.5 per cent) provided between 15 and 24 subjects of the total of 28 considered. But at the margins there was considerable variation. All but one of the grammar schools offered at least 15 subjects (the odd one out had 14) and over a quarter offered 25 or more. In contrast, nearly a fifth of the non-selective schools (19.6 per cent) had 14 or fewer available, and in five schools there were none. These schools entered pupils for alternatives such as the International Baccalaureate or vocational qualifications.

Chart 5.1: A-Levels Offered, 2007

Number of A-Levels	Non-Selective N	Non-Selective %	Grammar N	Grammar %	All Schools N	All Schools %
0-4[1]	13	1.5	0	0.0	13	1.4
5-9	33	3.9	0	0.0	33	3.5
10-14	120	14.2	1	0.9	121	12.7
15-19	314	37.2	25	22.7	339	35.5
20-24	300	35.5	53	48.2	353	37.0
25-28	65	7.7	31	28.2	96	10.1
Total	845	100.0	110	100.0	955	100.0

1. Five non-selective schools with viable sixth forms did not offer A-levels.

5.3 Our key questions centre on the role of the specialist science schools in physics education. Chart 5.2 locates A-level physics among the other A-levels. Some A-levels in some schools are taken in penny numbers, possibly at other schools, so we took a minimum entry of three as the criterion. On this basis, all but two of the grammar schools provided A-level physics, with the missing two - a maths & computing school and a technology school - being girls' schools. Provision in grammar schools was significantly above that in non-selective schools where 71.7 per cent had A-level physics available.

5.4 Among the 28 A-levels considered (classics, home economics, communication studies, Irish, Welsh and 'other modern languages' were omitted as having only a few entries), physics was the eleventh most popular. English and maths are the most frequently provided and they, along with history, biology, chemistry and geography, came above physics. But also outranking it are psychology, sports studies, design & technology and expressive arts.

Chart 5.2: A-Levels in Specialist Schools[1], 2007

Subject[2]	Non-Selective (N=845)	Grammar (N=110)	All Schools (N=955)
English	98.7	100.0	98.8
Maths	95.4	100.0*	95.9
History	95.0	100.0*	95.6
Biology	94.7	100.0*	95.3
Chemistry	90.1	99.1*	91.1
Geography	88.2	100.0*	89.5
Psychology	89.1*	80.0	88.1
Sport/PE	85.0	83.6	84.8
Design &Technology	80.7	92.7*	81.5
Expressive Arts[3]	76.1	73.6	75.8
Physics	71.7	98.2*	74.8
French	69.8	98.2*	73.1
Business Studies	66.2	88.2*	68.7
Media/Film/TV	69.9*	45.5	67.1
Music	62.7	90.9*	66.0
Sociology	70.1*	46.4	67.3
Religious Studies	60.8	85.5*	63.7
Art & Design	63.3	60.9	63.0
German	48.0	91.8*	53.1
General Studies	47.3	69.1*	49.8
Further Maths	44.7	88.2*	49.7
ICT	40.9	53.7*	42.8
Economics	35.0	66.4*	38.6
Political Studies	32.4	71.8*	37.0
Law	33.7*	16.4	31.7
Spanish	26.9	56.4*	30.3
Computing	18.6	32.7*	20.2
Other Science	12.0	19.1*	12.8
Critical Thinking	6.5	15.5*	7.5
Offering Any A-level	99.4	100.0	99.5

1. Percentages of specialist schools with sixth forms becoming operational between 2000 and 2005 offering the A-level.

2. Subject categories are those used by the JCQ in its annual publication of results in August, but communication studies, Irish, Welsh and 'other modern languages', home economics, and 'other subjects' have been omitted as having only a few entries.

3. Includes drama.

*. A-level more likely to be available in non-selective/grammar schools.

5.5 The A-level opportunities open to students depend to some extent on the type of school they go to. They are more likely to find psychology, media studies, sociology and law on offer in non-selective schools, but for most other A-levels there is a greater chance of the subject being available in a grammar school. Specialism also makes a difference, but it is less apparent at A-level than GCSE. Chart 5.3 shows that, among non-selective schools, A-level physics is more likely to be provided in those with the higher ability intakes, with the science schools along with other academic specialisms above those of the practical specialisms. The exception is humanities where A-level physics provision is noticeably lower, hinting perhaps at an influence of the designated specialism on the curriculum. However, at A-level, more so than GCSE, the initial character of the school seems to be the major influence on the A-levels provided. All the music schools, for example, whether selective or not, offered A-level physics as might be expected from their intakes and characteristics.

Chart 5.3. GCSE[1] and A-Level Physics[2] in Specialist Schools with Sixth Forms[3], 2007

Specialism[4]	Non-Selective[5]			Grammar[6]			Total Schools		
	N	% GC Physics	% AL Physics	N	% GC Physics	% AL Physics	N	% GC Physics	% AL Physics
Science	144	69.4	86.1	35	91.4	100.0	179	73.7	88.8
Maths & Computing	107	34.6	79.4	19	57.9	94.7	126	38.1	81.7
Languages	38	23.7	84.2	18	72.2	100.0	56	39.3	89.3
Humanities	31	32.3	64.5	8	-	-	39	33.3	71.8
Music	7	42.9	100.0	5	80.0	100.0	12	58.3	100.0
Performing Arts	155	26.5	68.4	8	75.0	100.0	163	28.8	69.9
Technology	110	33.6	68.2	4	100.0	75.0	114	36.0	68.4
Engineering	21	47.6	66.7	6	66.7	100.0	27	51.9	74.1
Business & Enterprise	116	23.3	60.3	2	-	-	118	24.6	61.0
Sports	116	19.0	62.9	5	-	-	121	20.7	64.5
Total	855	35.0	71.7	110	74.5	98.2[7]	955	39.6	74.8

1. More than five entries in GCSE physics.
2. Minimum of three entries in A-level physics.
3. Minimum of 20 students.
4. Designated as sole specialism or first specialism in a combination becoming operational between 2002-05.
5. Comprehensive and secondary modern.
6. Cells with three or fewer suppressed.
7. Two girls' grammar schools did not have a minimum of three students entered for A-level physics.

5.6 GCSE physics is being encouraged in the hope of reviving A-level take-up, and we will explore in the next chapter whether there are any signs of this happening. But, as a basis, we here consider whether those schools offering GCSE physics also offer the A-level. Overall, there is a positive correlation of +0.136 (N=845, P< 0.001). But within specialisms there is a significant association only in sports schools.

5.7 Chart 5.4 shows the percentages in the quadrants formed by cross-tabulating GCSE physics (yes, no) and A-level physics (yes, no). The science schools differ from the others in being the most likely to provide both GCSE and A-level physics. But they also are the most likely, apart from engineering schools, to have GCSE physics on offer without providing the A-level probably in consequence of being obliged to put on the GCSE. The other side of the coin is that they are the least likely to provide A-level physics without also having the GCSE. Only four science schools in 2007 had no entrants for either the GCSE or the A-level compared with over a fifth (21.3 per cent) of the specialist schools as a whole. The likelihood of neither GCSE nor A-level physics followed the familiar pattern of differences between academic and practical specialist schools.

Chart 5.4: Relation of GCSE Physics to A-Level Physics in Non-selective Schools[1], 2007

Specialism	N	Yes GC Yes AL	No GC Yes AL	Yes GC No AL	No GC No AL	Chi-Squared	P<
Science	144	58.3	27.8	11.1	2.8	1.22	ns
Maths & Computing	107	29.9	49.5	4.7	15.9	1.72	ns
Languages	38	21.1	63.2	2.6	13.2	0.19	ns
Humanities	31	22.6	41.9	9.7	25.8	0.19	ns
Music	7	42.9	57.1	0.0	0.0	-	-
Performing Arts	155	20.6	47.7	5.8	25.8	2.41	ns
Technology	110	24.5	43.6	9.1	22.7	0.59	ns
Engineering	21	33.3	33.3	14.3	19.0	0.10	ns
Business & Enterprise	116	16.4	44.0	6.9	32.8	1.48	ns
Sports	116	15.5	47.4	3.4	33.6	4.15	0.05
Total	845	28.0	43.7	7.0	21.3	15.67	0.001

1. Definitions as in footnotes to Chart 5.1.

5.8 Chart 5.5 traces the changing provision of GCSE and A-level physics in the science schools as they became operational between 2002 and 2005 through to the 2007 examinations.

Chart 5.5: Time Course of GCSE and A-Level Physics in Specialist Science Schools[1]

Year	Non-Selective			Grammar			All Schools		
	N	% GC Physics	% AL Physics	N	% GC Physics	% AL Physics	N	% GC Physics	% AL Physics
2002-03	77	36.4	89.6	12	91.7	100.0	89	43.8	91.0
2003-04	121	44.6	83.5	29	72.4	100.0	150	50.0	86.7
2004-05	143	51.4	86.0	35	82.9	100.0	178	57.9	88.8
2005-06	143	62.2	83.2	35	82.9	100.0	178	66.3	86.5
2006-07	144	69.4	86.1	35	91.4	100.0	179	73.7	88.8

1. Definitions as in footnotes to Chart 5.1.

5.9 As we saw in Chapter 2, both the number of science schools and the percentage offering GCSE physics increased, but Chart 5.5 reveals that so far there has been little impact on provision of the A-level. It has, in any case, been available in all the grammar schools. There is also a suggestion in the data that the schools initially opting for the science specialism were already strong in A-level physics.

5.10 Chart 5.6 shows the pattern for the availability of A-level physics across non-selective schools in all specialisms for the past three years. It underlines that there has so far been little change. The small variation is mainly due to schools close to the threshold criteria (at least 20 students in the sixth form and a minimum of three taking the A-level) dipping in and out of the year-by-year analyses.

Chart 5.6: A-Level Physics in Non-Selective Schools by Specialism[1]

Specialism	2005 Total Schools	2005 With AL Physics	2005 %	2006 Total Schools	2006 With AL Physics	2006 %	2007 Total Schools	2007 With AL Physics	2007 %
Science	143	123	86.0	143	119	83.2	144	124	86.1
Maths & Computing	108	83	76.9	109	81	74.3	107	85	79.4
Languages	39	33	84.6	39	26	66.7	38	32	84.2
Humanities	31	22	71.0	31	24	77.4	31	20	64.5
Music	7	6	85.7	7	7	100.0	7	7	100.0
Performing Arts	153	107	69.9	155	101	65.2	155	106	68.4
Technology	112	77	68.8	111	80	72.1	110	75	68.2
Engineering	20	16	80.0	21	15	71.4	21	14	66.7
Business & Enterprise	114	69	60.5	115	67	58.3	116	70	60.3
Sports	117	73	62.4	118	70	59.3	116	73	62.9
Total	844	609	72.2	849	590	69.5	845	606	71.7

1.For definitions of categories see Chart 5.1.

5.11 Approaching three-quarters, 74.8 per cent, of schools with sixth forms (grammar and non-selective together) offer A-level physics, and logistic regression could not improve on a prediction of three correct out of four. It did, however, highlight the main associations. It showed that a grammar school is almost ten times as likely to have the A-level available as a non-selective school, that science schools were almost twice as likely, and there was also a significant link with the provision of GCSE physics.

Chart 5.7: Predicting[1] A-Level Physics[2] Provision

Variable	Odds Ratio	P<
Grammar School	9.81	0.002
Science School	2.03	0.01
GCSE Physics	1.05	0.001

1. Logistic regression of the 955 schools becoming operational as specialist schools between 2002 and 2005 with sixth forms (minimum of 20 students at Key stage 5).

2. Minimum of three entries in A-level physics.

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5.12 Approaching three-quarters (72.5 per cent) of the target population of specialist schools provided between 15 and 24 A-levels in 2007. Physics was the eleventh most popular of the 28 subjects considered, coming behind other traditional subjects and also psychology, sports studies, design and technology, and expressive arts. The proportion of science schools offering A-level physics was similar to that of the maths & computing, languages and music schools and above that of the other specialisms. This pattern is consistent with differences in intakes.

5.13 More science schools offered both GCSE and A-level physics than those with other specialisms, but these schools were more likely to offer A-level physics without having put on the GCSE. Although the proportion of science schools offering GCSE physics has grown (reflecting the obligation on them to do so), there has been little impact so far on A-level availability. GCSE and A-level physics provision correlates overall but not within specialisms.

6. A-Level Physics Participation

6.1 If so far there is little sign of specialist science status increasing the availability of A-level physics, what about the number of sixth form students entered for the subject? Chart 6.1 traces participation levels from the inception of science schools in 2002 through to 2007, the latest year for which the examination results were available to us in this form. There is an indication that the first schools to achieve specialist science status, both grammar and non-selective, were already strong in the subject, but the addition of others seems to have had only a small effect on average take-up per school.

Chart 6.1: Take-Up[1] of A-level Physics in Science Schools

Year	Non-Selective Science Schools	Non-Selective Per Cent Year 13	Grammar Science Schools	Grammar Per Cent Year 13	All Schools Science Schools	All Schools Per Cent Year 13
2002-03	69	11.8	12	20.3	81	13.0
2003-04	101	11.2	29	16.5	130	12.3
2004-05	123	10.6	35	17.6	158	12.1
2005-06	119	11.1	35	16.7	154	12.4
2006-07	124	10.8	35	16.7	159	12.1

1. Mean percentage of Year 13 entered for A-level physics in science schools with a minimum of three entries.

6.2 This is borne out by the trends across all specialisms shown in Chart 6.2, again, as in earlier chapters, confining the analysis to non-selective schools. The only suggestion of a change is in the humanities and performing arts schools where A-level physics take-up seems to have fallen somewhat.

Chart 6.2: A-Level Physics in Non-Selective Schools[2]

Specialism	2005 N	2005 %	2006 N	2006 %	2007 N	2007 %
Science	123	10.6	119	11.1	124	10.8
Maths & Computing	83	10.6	81	9.5*	85	10.0
Languages	33	10.6	26	11.5	32	10.0
Humanities	22	10.5	24	8.3*	20	7.9*
Music	6	8.5	7	9.2	7	8.0
Performing Arts	107	9.7	101	9.2*	106	8.8*
Technology	77	10.8	80	9.9	75	10.6
Engineering	16	13.3	15	12.1	14	12.4
Business & Enterprise	69	9.3	67	10.0	70	9.5
Sports	73	11.9	70	11.4	73	10.1
Total	609	10.5	590	10.2	606	9.9

1. Mean percentage of Year 13 entered for A-level physics in science schools with a minimum of three entries.

2. Comprehensive and secondary modern.

* Significantly different from science schools at the five per cent level.

6.3 The focus in Chart 6.2 is on non-selective schools because previously we have found big differences associated with grammar schools. Chart 6.3 shows that A-level physics entries are no exception. On average, take-up in the grammar schools was, in 2007, about fifty per cent higher. The specialist science grammars had proportionately the largest groups, and the non-selective science schools also exceeded all other specialisms except engineering. Only the differences from humanities and performing arts schools, however, reached the five per cent level of statistical significance. Nevertheless, although Chart 6.1 does not show any growth in A-level physics entries per school between 2002-03 and 2006-07, there are indications in Chart 6.3 that the science schools have higher take-up than other specialisms. This apparent discrepancy can be explained by bearing in mind what we saw in Chart 6.1, namely that schools opting to become science schools tended to be already strong in the subject.

Chart 6.3: Take-Up[1] of A-Level Physics in 2007

Specialism	Non-Selective		Grammar		All Schools	
	N	%	N[2]	%	N	%
Science	124	10.8	35	16.7	159	12.1
Maths & Computing	85	10.0	18	15.5	103	10.9
Languages	32	10.0	18	14.5	50	11.6
Humanities	20	7.9*	8	14.5	28	9.8
Music	7	8.0	5	15.0	12	11.0
Performing Arts	106	8.8*	8	14.6	114	9.2*
Technology	75	10.6	-	-	78	10.7
Engineering	14	12.4	6	14.7	20	13.1
Business & Enterprise	70	9.5	-	-	72	9.5*
Sports	73	10.1	5	15.0	78	10.4
Total	606	9.9	108	15.3	714	10.8

1. Mean percentage of Year 13 entered for A-level physics in specialist schools designated between 2002 and 2005 having a minimum of three entries in the subject and sixth forms of at least 20 students.

2. Cells with three entries or fewer suppressed.

*. Significantly different from science schools at the five per cent level.

6.4 In Chapter 3 a similar story emerged for GCSE physics. Although more schools were offering the GCSE, percentage entry per school had not increased (rather the reverse as weaker schools responded to the requirement to introduce it). Nevertheless in the 2007 examinations entries were higher in science schools than in most other specialisms. This effect is sharpened for both GCSE and A-level when, as in Chart 6.4, we include only those schools with sixth forms. Although few of the differences are statistically significant, the size of the GCSE physics entry from science schools stands above all other specialisms. Compared with all non-selective science schools (see Chart 3.2, page 16), the entry from those with sixth forms was about a percentage point higher.

6.5 Chart 6.4 also shows A-level physics entries. It is noticeable that more than double the schools provide A-level physics as GCSE physics, but take up of the A-level is only about two-thirds that of the GCSE. Again entries from science schools tended to be higher than from other specialisms. Some correlations might, therefore, be anticipated between the percentage entries in the GCSE and the A-level, and this proves to be the case. For all 955 schools in the population (that is including grammar schools) a highly significant correlation of +0.429 is obtained. In partial correlation, with grammar school controlled for, the coefficient remains highly significant at +0.309, as it does with specialism controlled for when it becomes +0.398. That is, the relation holds irrespective of selection or type of specialism.

Chart 6.4: Non-Selective Schools with Sixth forms, 2007

Specialism[1]	N[2]	GCSE		A-Level	
		Schools[3]	Per Cent Entries[4]	Schools[5]	Per Cent Entries[6]
Science	144	100	18.5	124	10.8
Maths & Computing	107	37	14.6*	85	10.0
Languages	38	9	14.7	32	10.0
Humanities	31	10	13.4	20	7.9*
Music	7	3	15.9	7	8.0
Performing Arts	155	41	13.1*	106	8.8*
Technology	110	37	14.8	75	10.6
Engineering	21	10	12.6	14	12.4
Business & Enterprise	116	27	15.9	70	9.5
Sports	116	22	15.5	73	10.1
Total	845	296	15.8	606	9.9

1. Sole or first specialism in combination.

2. Non-selective specialist schools that became operational between 2002 and 2005, with a minimum of 20 in the sixth form.

3. Schools with more than five entrants in GCSE physics.

4. Mean percentage of pupils at the end of Key Stage 4 entered for GCSE physics in those schools offering the subject.

5. Schools with at least three entrants in A-level physics.

6. Mean percentage of the students at the end of Key Stage 5 entered for A-level physics in those schools offering the subject.

*. Significantly different from science schools at the five per cent level.

6.6 The strong relationship between GCSE and A-level physics take-up makes it interesting to repeat the analysis of Chart 6.3 for only those schools offering GCSE physics. Chart 6.5 shows that this refinement leads to a general increase in percentage A-level entries, with the mean up by 1.8 percentage points. There are increases even in the humanities, performing arts and business & enterprise schools where only a few offered GCSE physics. Confining the analysis to only those schools offering GCSE physics eliminates the statistically significant differences between specialisms recorded in Chart 6.3. Although there is a strong correlation between the take-up of GCSE and A-level physics it does not mean the relationship is causal. It could be that schools which are strong in science (for example in the quality of their teaching) have the larger numbers entering at both GCSE and A-level. Over time it will become clearer whether there is a causal connection, as more data become available to assess the effect on A-level entry of the government's drive to re-introduce GCSE physics.

Chart 6.5: A-Level Participation[1] in GCSE Physics Schools

Specialism	Non-Selective N	Non-Selective %	Grammar N[2]	Grammar %	All Schools N	All Schools %
Science	84	11.4	32	17.7	116	13.2
Maths & Computing	32	10.4	11	17.2	43	12.1
Languages	8	11.9	13	16.3	21	14.6
Humanities	7	9.1	-	-	10	12.7
Music	-	-	4	16.6	7	13.2
Performing Arts	32	9.6	6	16.5	38	10.7
Technology	27	11.5	-	-	30	11.5
Engineering	7	9.9	4	15.9	11	12.1
Business & Enterprise	19	10.1	-	-	21	10.0
Sports	18	12.9	-	-	21	13.4
Total	237	10.9	81	16.8	318	12.4

1. Mean percentage of Year 13 entered for A-level physics in specialist schools with a minimum of six entries in GCSE physics and a minimum of three entries in A-level physics.

2. Cells with three entries or fewer suppressed.

6.7 The correlation between GCSE and A-level physics take-up also emerges in the regression analysis of A-level participation in Chart 6.6, but the strongest predictor is gender. General GCSE performance also makes a contribution. These were the main elements in the most economical regression equation obtained, which correlated to the extent of +0.299 with A-level physics participation and accounted for 9.0 per cent of the variance. School specialism was not part of the final equation, presumably because its variance was already covered by these three variables.

Chart 6.6: Predicting Take-up of A-Level Physics[1]

Variable	Beta	t	P<
Constant		11.40	.001
% Girls in Sixth Form	-.236	-5.96	.001
% Entries in GCSE Physics	.133	3.32	.001
% Five Good GCSEs inc Eng & Maths	.094	2.30	.05

1. The columns show the standardized regression coefficients, t scores and statistical significance. The higher the beta the better the prediction, the lower the probability the less likely is this is to have been obtained by chance (.05, one in twenty, is taken as the cut off point).

6.8 At A-level the picture is, therefore, similar to that at GCSE. Specialist science schools with sixth forms are more likely to provide A-level physics, but its take-up is predicted more by gender, ability and GCSE physics than school specialism.

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6.9 Specialist status appears to have had little effect on A-level physics take-up across the specialisms except for some suggestion of a fall in the humanities and performing arts schools. A-level entries in physics tended to be higher in grammar and science specialist schools which were already strong in science. There is a correlation between the take-up of GCSE and A-level physics, but this need not be causal and it will take time for any effects of the drive to triple science to show through. Regression analysis showed that the main predictors of A-level physics participation were gender, ability and GCSE physics take-up, with any contribution from school specialism covered by these variables.

7. A-Level Physics Performance

7.1 Although science specialist status does not appear as yet to be associated with increased A-level physics provision and participation, there is some suggestion in Chart 7.1 that in non-selective schools there could have been some improvement in performance. There was at first a drop in the average percentage of A grades as a wider range of schools acquired science status, but since the nadir in the 2005 exams there has been an improvement of 5.5 percentage points.

Chart 7.1: A-Level Physics Performance[1] in Science Schools

Year	Non-Selective		Grammar		All Schools[4]	
	Science Schools	% A	Science Schools	% A	Science Schools	% A
2002-03	69	21.0	12	33.0	81	22.8
2003-04	101	18.7	29	36.4	130	22.6
2004-05	123	18.2	35	36.3	158	22.2
2005-06	119	21.3	35	38.3	154	25.2
2006-07	124	23.7	35	36.9	159	26.6

1. Mean percentage A grades in A-level physics with a minimum of three entries in the subject in specialist schools having sixth forms with a minimum of 20 students in Key Stage 5.

7.2 Chart 7.2, however, shows that this improvement was general, with an overall increase of 4.4 percentage points. Other academic specialisms showed similar improvements to the science schools, but the practical specialisms rather less. Nationally, in those three years, the proportion of A grades awarded in A-level physics in England went up by 2.5 percentage points. The science schools may then have been lifted on a rising tide rather than contributing anything in particular of their own.

Chart 7.2: A-Level Physics Performance[1] in Non-Selective Schools

Specialism	2005		2006		2007	
	N	% A	N	% A	N	% A
Science	123	18.2	119	21.3	124	23.7
Maths & Computing	83	19.2	81	19.7	85	24.4
Languages	33	17.8	26	21.3	32	26.5
Humanities	22	17.9	24	23.5	20	19.5
Music	6	18.8	7	23.5	7	36.0
Performing Arts	107	14.4	101	20.5	106	20.7
Technology	77	14.1	80	16.8	75	17.3*
Engineering	16	15.6	15	11.4*	14	13.0*
Business & Enterprise	69	16.8	67	18.5	70	17.2*
Sports	73	15.7	70	15.9*	73	18.2*
Total	609	16.6	590	19.3	606	21.0

1. Mean percentage A grades in A-level physics in specialist schools with a minimum of three entries in the subject.

*. Significantly different from science schools at the five per cent level.

7.3 The differences between the schools appeared to grow over the three years. Whereas A-level performance in science schools in 2005 was not significantly different from that in any other specialism, by 2006 a significant gap had opened up on engineering and sports schools, and in 2007 this extended to technology and business & enterprise schools. This pattern is consistent with the prior attainment differences shown in Chart 3.5 (page 18). The importance of ability is underlined by the comparisons between the non-selective schools and grammar schools shown in Chart 7.3.

Chart 7.3: A-Level Physics Performance[1] in 2007

Specialism	Non-Selective N	Non-Selective % A	Grammar[2] N	Grammar[2] % A	All Schools N	All Schools % A
Science	124	23.7	35	36.9	159	26.6
Maths & Computing	85	24.4	18	39.3	103	27.0
Languages	32	26.5	18	38.0	50	30.7
Humanities	20	19.5	8	26.5	28	21.5
Music	7	36.0	5	61.1	12	46.5*
Performing Arts	106	20.7	8	37.6	114	21.9*
Technology	75	17.3*	-	-	78	18.2*
Engineering	14	13.0*	6	36.5	20	20.0
Business & Enterprise	70	17.2*	-	-	72	17.3*
Sports	73	18.2*	5	25.1	78	18.7*
Total	606	21.0	108	37.2	714	23.4

1. Mean percentage A grades in A-level physics with a minimum of three entries in the subject in specialist schools having sixth forms with a minimum of 20 students in Key Stage 5.

2. Cells with three entries or fewer suppressed.

*. Significantly different from science schools at the five per cent level.

7.4 Overall, the grammar schools achieved approaching double the percentage of A grades in A-level physics as the non-selective schools (37 per cent against 21 per cent). None of the differences between the grammar school specialisms was significant, though the proportions ranged from 61 per cent in the music schools to 26.5 per cent in humanities and 25.1 in sports schools. When all schools are considered, music schools have the best A-level physics results, with the science schools in a group including maths & computing and languages. All three were significantly above performing arts, technology, business & enterprise and sports. Again there seems to be an academic/practical split rather than science schools being distinctive.

7.5 Considering the 388 schools (grammars and non-selective) offering both GCSE physics and A-level physics, A grades at A-level correlate with A*/A at GCSE to the extent of +0.321, significant at the 0.001 level. In partial correlation, with grammar controlled for, the relationship becomes +0.147, $P<0.01$; with specialism controlled for, +0.296, $P<0.001$; and with both controlled for, it becomes +0.128 remaining significant at the five per cent level.

7.6 It might have been anticipated, therefore, that performance in the GCSE would have been a good predictor of performance in the A-level. But, as with GCSE physics itself, the strongest association was developed ability as measured by general GCSE performance. Chart 7.4 shows the main components of a regression equation which accounted for 9.5 per cent of the variance (R=.308). Five good GCSEs contributed most, but school specialism (scored from science through to sports) and school type (foundation and voluntary aided) also played a part.

Chart 7.4: Predicting[1] A-Level Physics Performance

Variable	Beta	t	P<
Constant		2.5	.05
% Five Good GCSEs inc Eng & Maths	.271	6.82	.001
Specialism	-.121	-3.09	.01
School Type	-.090	-2.27	.05

1. The columns show the standardized regression coefficients, t scores and statistical significance. The higher the beta the better the prediction, the lower the probability the less likely is this is to have been obtained by chance (.05, one in twenty, is taken as the cut off point).

7.7 As at GCSE level, gender was prominent in A-level take-up but not performance. Interestingly, those girls who took the A-level did appreciably better than the boys (in 2007, 35.3 per cent were awarded an A grade against 29.5 per cent) which is a reversal of their relative performance at GCSE. The likely explanation is that because it is unusual for girls to take A-level physics those that do will be more confident of their abilities and interest.

Résumé

7.8 Science specialist schools have improved their percentage of A grades in A-level physics from 2005 to 2007, but schools with other academic specialisms have done so also, and it seems mainly to reflect the increase in A grades awarded. Among non-specialist schools, A-level performance was similar in science, maths & computing, languages and music schools, and significantly above that in technology, engineering, business & enterprise, and sports schools. A-level physics performance correlated significantly with GCSE physics performance even with specialism and selection controlled for. In regression analysis it was general GCSE performance rather than specifically GCSE physics performance that proved to be the best predictor of the A-level, with specialism (scored from science to sport) and school type (scored from foundation to community) also playing a part. As with GCSE physics, gender was significantly associated with take-up, but not performance.

8. Characteristics of Specialist Schools

8.1 We have already discussed the bearing of intake differences on physics provision, take-up and performance in the various types of specialist schools (see for example, Charts 3.4 and 3.5, pages 17 and 18). In this chapter we explore those differences in more detail and in the next we look at the differences between specialist and non-specialist schools to see what they tell us about school improvement and physics provision. We then in Chapter 10 go on to report the results of a survey which asked the headteachers of science schools and a comparable group of other specialist schools how they came to choose the specialism they did.

Selective and Non-selective Schools

8.2 Chart 8.1 shows that the distribution of schools across the specialisms is far from random. It is possible to recognise three groups: the 'academic', the 'practical' and, as we shall consider in the next chapter, the non-specialist. About twice as many non-selective schools (57.2 per cent) as grammar schools (28.7 per cent) adopted practical specialisms (performing arts through to sports). For the academic specialisms (science through to music), the proportions were more than reversed (29.6 per cent against 69.5 per cent). The great majority of the schools yet to be designated are non-selective (13.1 per cent compared with 1.8 per cent).

Chart 8.1: Secondary Schools[1] by Specialism[2]

Specialism	Non-Selective[3]		Grammar		All Schools	
	N	%	N	%	N	%
Science	293	10.1	40	24.4	333	10.8
Maths & Computing	252	8.7	21	12.8	273	8.9
Languages	191	6.6	35	21.3	226	7.4
Humanities	107	3.7	12	7.3	119	3.9
Music	19	0.7	6	3.7	25	0.8
Performing Arts	451	15.5	9	5.5	460	15.0
Technology	545	18.7	16	9.8	561	18.3
Engineering	57	2.0	8	4.9	65	2.1
Business & Enterprise	252	8.7	5	3.0	257	8.4
Sports	360	12.4	9	5.5	369	12.0
Non Specialist	382	13.1	3	1.8	385	12.5
Total	2,909	100.0	164	100.0	3,073	100.0

1. Does not include middle schools.
2. As at January 2008.
3. Comprehensive and secondary modern.

Comparisons of Non-Selective Specialist Schools

8.3 Since the grammar schools are spread very unevenly across the different specialisms and they differ from non-selective schools in a number of ways, for the rest of this chapter and the next we confine our comparisons to the 2,909 non-selective schools.

Intakes

8.4 Chart 8.2 shows that even among the non-selective schools there are considerable differences in intakes. If we take as the basis for comparison science schools, which are the focus of this report, we can see that the mean Key Stage 2 scores, eligibility for free schools meals and the two measures of special needs differ considerably from the schools in what we have called the 'practical' specialisms. In all cases the intakes of practical specialist schools appear the more disadvantaged. Among the academic specialisms the humanities are distinctive in having lower entry scores and higher eligibility for free school meals and special needs than the science schools. This is interesting because as we saw in Chart 7.3 (page 36) the humanities schools have the poorest performance in A-level physics among the academic specialisms.

Chart 8.2: Intake Characteristics[1]

Specialism	Key Stage 2 Scores	Eligibility for Free School Meals	Special Needs with Statements	Special Needs Supported
Science	27.42	13.04	6.85	10.25
Maths & Computing	27.14*	14.57	7.37	11.11
Languages	27.57	13.05	6.18	10.20
Humanities	27.02*	16.38*	7.93*	12.66*
Music	27.75	12.67	7.89	11.06
Performing Arts	26.91*	16.97*	8.33*	12.00*
Technology	27.10*	14.16	7.51	11.37*
Engineering	26.68*	18.20*	10.02*	12.12
Business & Enterprise	26.73*	18.12*	8.26*	12.91*
Sports	26.69*	16.96*	8.76*	13.22*
Non Specialist	25.85*	23.95*	10.21*	15.20*
Total	26.89	16.45	8.06	12.10

1. Means.

*. Significantly different from science schools at the five per cent level.

8.5 Chart 8.3 presents these differences in summary form, comparing directly what we are calling the 'academic' and the 'practical' specialisms. It clearly brings out the recurring pattern. But Chart 8.2 had also revealed that the non-specialist schools are the most distinctive of all. Their intakes have lower prior attainment and higher social needs than all types of specialist school. This is no accident since schools have to meet performance standards to achieve specialist status. It does mean, however, that it is not possible to demonstrate the success of specialist schools by comparisons with the non-specialist as some have attempted to do (for example, Jesson and Crossley, 2006). We will explore this issue in more detail in the next chapter. It is important because the claimed differences have been the main justification for the specialist schools policy.

Chart 8.3: Intakes

Characteristic	Academic[1] (862)	Practical[2] (1,525)	F	P<
Mean Key Stage 2 Score	27.32	26.89	72.7	.001
% Free School Meals	13.89	16.26	19.2	.001
% Special Needs with Statements	7.01	8.20	37.1	.001
% Special Needs Supported	10.80	12.20	24.7	.001

1.Science, maths &computing, languages, humanities and music.

2. Performing arts, technology, engineering, business & enterprise and sports.

School Characteristics

8.6 As well as differing in intakes, the types of specialist school differ in their characteristics. The patterning in Chart 8.4 is somewhat less sharp than for intakes, but there are clearly discernible differences. The academic specialist schools are more likely to be voluntary aided or foundation and, therefore, in charge of their own admissions. Since the voluntary aided are faith schools a similar division holds here. Unusually the non-specialist schools tend to be close to the average in these respects. But they did differ appreciably from all types of specialist school in only a third having sixth forms. The single-sex schools tended more often to adopt an academic specialism, but there were some interesting differences with gender. Girls' schools most often were music or languages schools and none had opted for engineering. In contrast, boys' schools most often became engineering or maths & computing schools, and none had specialized in music. Girls' schools were less likely and boys' school more likely to be non-specialist.

Chart 8.4: School Characteristics

Specialism	% VA or Foundation	% Faith School	% Sixth Form	% Girls' School	% Boys' School
Science	37.9	23.5	55.6	7.8	5.1
Maths & Computing	37.7	21.8	52.8	5.2	8.3
Languages	38.2	18.3	60.7	13.1	1.6
Humanities	43.9	34.6	54.2	9.3	2.8
Music	57.9	36.8	52.6	15.8	0.0
Performing Arts	31.5	12.6	54.3	6.7	1.6
Technology	34.1	13.8	59.6	5.0	3.7
Engineering	19.2	12.3	42.1	0.0	8.8
Business & Enterprise	31.3	17.9	58.3	7.1	4.0
Sports	25.8	11.7	53.6	1.4	5.0
Non Specialist	32.5	20.7	33.2	2.6	5.2
Total	33.4	17.5	53.0	5.6	4.2

1. Percentages.

8.7 These interpretations are borne out by the statistical analysis of Chart 8.5 where the academic and practical specialisms are compared. Clear differences emerge underlining the differentiated picture of Chart 8.4. Academic specialist schools were more likely than the practical to be a voluntary aided or foundation school, to be a faith school and to be single sex. There was no difference in age range - both types of specialism were as likely to have a sixth form. Here, as we saw in Chart 8.4, the big difference was with the non-specialist schools.

Chart 8.5: School Characteristics

Characteristic	Academic[1] (862)	Practical[2] (1,525)	Chi-squared	P<
% VA/Foundation	39.1	30.7	18.0	.001
% Faith	23.5	13.6	40.1	.001
% Sixth Form	55.7	56.1	0.0	ns
% Single sex	13.5	8.4	15.9	.001

1.Science, maths &computing, languages, humanities and music.

2. Performing arts, technology, engineering, business& enterprise and sports.

Performance

8.8 As with intakes and characteristics, non-selective specialist schools also differ in their performance. In Charts 8.6 and 8.7 we look at three measures, the Key Stage 3 results, the percentages getting five good GCSEs including English and maths, and contextualised value added scores from Key Stage 2 to GCSE.

Chart 8.6: Performance[1]

Specialism	Key Stage 3 Scores	Five Good GCSEs inc Eng & Maths	Contextual Value Added
Science	34.89	50.57	1,002.69
Maths & Computing	34.26*	47.53*	1,001.28
Languages	34.95	52.58	1,001.40
Humanities	34.00*	45.49*	1,002.76
Music	35.40	53.32	999.57
Performing Arts	33.69*	43.55*	1,001.39
Technology	34.21*	46.89*	1,003.67
Engineering	33.23*	37.51*	998.13
Business & Enterprise	33.42*	41.94*	1,003.04
Sports	33.31*	39.90*	1,000.84
Non Specialist	31.58*	32.22*	994.24*
Total	33.71	44.06	1,001.23

1. Means.

*. Significantly different from science schools at the five per cent level.

8.9 Although the Key Stage 3 scores may not look very different they are highly significant because of the low standard error. They are closely in line with the Key Stage 2 results (see Chart 8.2) and GCSE performance where the dramatic differences are readily apparent. The music, languages and science schools achieve the highest scores in all three and they differ significantly from the practical specialisms and also the maths & computing and humanities schools. The consistency of this pattern from age 11 to age 14 to age 16 suggests that the different specialisms may be scoring similarly in terms of contextual value added from Key Stage 2 to GCSE. This is borne out by Chart 8.6. Chart 8.7 summarises the comparisons between the academic and practical specialisms. For both Key Stage 3 and GCSE the differences are highly significant and indeed greater than at Key Stage 2, suggesting the schools were growing further apart. But no difference was found in contextual value added.

Chart 8.7: Performance of Academic and Practical Specialisms

Characteristic	Academic[1] (862)	Practical[2] (1,525)	F	P<
Mean Key Stage 3 Score	34.62	33.72	89.2	.001
% Five Good GCSEs inc Eng & Maths	49.54	43.40	89.0	.001
Mean Contextual Value Added Scores	1,001.93	1,002.08	0.1	ns

1. Science, maths &computing, languages, humanities and music.

2. Performing arts, technology, engineering, business & enterprise and sports.

Résumé

8.10 Schools in 2007 fell into one of three groups: those with ‘academic’ specialisms, those with ‘practical’ specialisms, and the non-specialist. Grammar schools (69.5 per cent against 29.6 per cent) were more likely to adopt academic specialisms, and non-selective schools (57.2 per cent against 28.7 per cent), practical specialisms. Non-selective schools were more likely than grammar schools to still be without specialist status in January 2008 (13.1 per cent compared with 1.8 per cent). Those adopting academic specialisms tended to have intakes with higher Key Stage 2 scores, lower eligibility for free schools meals, and more special needs pupils both with and without statements. Schools with academic specialisms were more likely to be voluntary aided or foundation, to be a faith school or single sex, but there was no difference with regard to age range. The academic non-selective specialist schools also achieved better Key Stage 3 and GCSE results, but there was no difference in contextual value added.

9. Non-Specialist Schools

9.1 In this chapter we ignore the differences between specialist schools discussed in Chapter 8 and treat them as a group which we then compare with those that do not have specialist status. Again, we leave aside the grammar schools as a complicating factor and concentrate on the nominally non-selective schools. Chart 9.1 shows that non-specialist schools differ sharply from specialist schools on all the intake and performance variables. They are also mainly 11-16 schools, with boys' schools over-represented and girls' schools under-represented. They did not differ, however, in terms of being a voluntary aided/foundation or a faith school. Unlike the intra-specialist-schools comparisons, there is a difference in contextual value added between the non-specialist and specialist schools. When this result has been obtained elsewhere it has been taken as a vindication of the specialist schools policy by the Specialist Schools and Academies Trust (for example Jesson and Crossley, 2006). However, it would be wrong to ignore the influence of the very considerable intake differences.

Chart 9.1: Comparisons of Specialist and Non Specialist Schools

Characteristic	Specialist (2,527)	Non- Spec (382)	Chi-squared or F	P<
Mean Key Stage 2 Scores	27.04	25.85	275.7	.001
% Free School Meals	15.44	23.95	126.7	.001
% Special Needs Statemented	7.80	10.21	67.2	.001
% Special Needs Supported	11.72	15.20	70.6	.001
% VA/ Foundation	33.6	32.5	0.2	ns
% Faith	17.0	20.7	3.2	ns
% Sixth Form	56.0	33.2	68.7	.001
% Girls' Schools	6.1	2.6	8.4[1]	.05
% Boys' Schools	4.0	5.2		
Mean Key Stage 3 Scores	34.03	31.58	337.0	.001
% Five Good GCSEs inc Eng & Maths	45.50	32.22	193.4	.001
Mean Contextual Value Added Scores	1,002.08	994.24	58.6	.001

1. In the case of girls', boys' and coeducational schools, chi-squared from a 3*2 comparison.

9.2 In Chart 9.2 the unfolding of the specialist schools policy is traced through four periods: (1) 1994-1997 (Conservative technology schools policy); (2) 1998-2001 (specialist schools policy takes shape); (3) 2002-2005 (period of maximum growth) and (4) 2006-2008 (recent designations). Under the Conservative government 6.9 per cent of non-selective schools became specialist. In the first Blair parliament a further 14.3 per cent were designated, but the main period of growth occurred between 2002 and 2005 when 53 per cent adopted specialisms. These Phase 3 schools are extensively analysed in relation to physics education in Chapters 2 to 7. In the fourth period a further 12.6 per cent schools became operational, leaving just 382 as non-specialist. By January 2008, 86.9 per cent of all non-selective state secondary schools (excluding the middle schools, special schools and CTCs/academies) had assumed at least one specialism.

Chart 9.2: Time Course of Non-Selective Specialist Schools Becoming Operational

Date Operational	Not Specialist		Operational in Phase		Specialist Already		Total	
	N	%	N	%	N	%	N	%
Phase 1 (1994-97)	2,708	93.1	201	6.9	-	-	2,909	100.0
Phase 2 (1998-2001)	2,292	78.8	416	14.3	201	6.9	2,909	100.0
Phase 3 (2002-05)	749	25.7	1,543	53.0	617	21.2	2,909	100.0
Phase 4 (2006-07)	382	13.1	367	12.6	2,160	74.3	2,909	100.0

9.3 The specialist and non-specialist schools in these four waves are compared in the same sequence as in Chapter 8. Chart 9.3 focuses on intakes, Chart 9.4 on school characteristics and Chart 9.5 on performance. The specialist schools in any period are defined as the schools that became operational during it (second pair of columns in Chart 9.2). Schools that had become specialist already (third pair) are parked for the purposes of these comparisons. In all cases, the specialist schools emerged as the more advantaged in analyses of the 2006-07 database. Their intakes had higher prior attainment and fewer social or special needs. They achieved better results at Key Stage 3 and GCSE, and they were more effective in terms of the DCSF's measure of contextual value added.

Chart 9.3: Intake Characteristics[1] for Each Phase

Date Operational	Key Stage 2 Scores		Free School Meals		Statemented Special Needs		Special Needs Supported	
	NS[2]	S[3]	NS[2]	S[3]	NS[2]	S[3]	NS[2]	S[3]
Phase 1 (1994-97)	26.84	27.55	16.78	12.13	8.20	6.17	12.25	10.10
Phase 2 (1998-2001)	26.79	27.05	16.88	16.22	8.31	7.62	12.44	11.23
Phase 3 (2002-05)	26.16	27.10	22.29	14.44	9.76	7.68	14.31	11.63
Phase 4 (2006-07)	25.85	26.47	23.95	20.71	10.21	9.37	15.20	13.57

1. Of schools becoming operational in the specialism during the phase.
2. Not Specialist
3. Specialist.

Chart 9.4: School Characteristics[1] for Each Phase

Date Operational	Sixth Form		VA/Foundation		Faith		Single Sex	
	NS[2]	S[3]	NS[2]	S[3]	NS[2]	S[3]	NS[2]	S[3]
Phase 1 (1994-97)	51.6	71.1	31.8	54.7	17.4	18.9	9.4	15.4
Phase 2 (1998-2001)	49.4	63.7	32.2	30.0	17.8	14.7	9.6	8.2
Phase 3 (2002-05)	37.1	55.4	29.5	33.4	19.0	17.3	9.9	9.5
Phase 4 (2006-07)	33.2	41.1	32.5	26.4	20.7	17.2	7.9	12.4

1. Of schools becoming operational in the specialism during the phase.
2. Not Specialist.
3. Specialist.

9.4 The differences between specialist and non-specialist schools opened up from the start because applications were first restricted to grant maintained schools. These were being generously funded by the government of the day in the hope that more would opt out of local authority control. Chart 9.4 shows that specialist schools in the first wave were the more likely to have sixth forms, to control their own admissions, to be faith schools and to be single sex. But as the scheme was opened up these distinctive features, apart from having a sixth form, tended to disappear.

Chart 9.5: Performance[1] for Each Phase

Date Operational	KS3 Scores		GCSE Results		Value Added	
	NS[2]	S[3]	NS[2]	S[3]	NS[2]	S[3]
Phase 1 (1994-97)	33.61	35.07	33.61	35.07	1,000.81	1,006.81
Phase 2 (1998-2001)	33.52	34.08	33.52	34.08	1,000.23	1,003.81
Phase 3 (2002-05)	32.26	34.13	32.26	34.13	997.26	1,001.53
Phase 4 (2006-07)	31.58	32.95	31.58	32.95	994.23	999.82

1. Of schools becoming operational in the specialism during the phase.
2. Not Specialist.
3. Specialist.

9.5 Charts 9.3 to 9.5 also show that as each new tranche of specialist schools was added it tended to differ from those in previous periods. In each successive wave the schools awarded specialist status tended to have intakes with poorer Key 2 scores, more pupils from low-income backgrounds, and more with special needs. There were corresponding decreases in Key Stage 3 and GCSE performance. Interestingly, contextual value added also appeared to be lower. But it needs to be borne in mind that to achieve specialist status, a school has to meet performance and other criteria, including being able to show that it adds value. It seems clear from Chart 9.5 that the approval process continually drew off the better performing schools, and it is not surprising that contextual value added (CVA) should fall into the same pattern

9.6 The differences between specialist and non-specialist schools tend to increase with time and the longer a school has been specialist, the more value it appears to add. Great significance has been attached to comparable results by Jesson (2003) who sees them as a demonstration of effectiveness, fully vindicating the specialist schools policy. Charts 9.3 to 9.5, however, point to an alternative and we believe more likely explanation. They show that the specialist schools programme began with a sub-set of advantaged schools and during each successive phase there has been creaming off from the schools remaining. This gives the impression that holding specialist status makes a school more effective, but our data point to the specialist schools being the more effective in the first place. Schagen and Goldstein (2002) also reached this conclusion.

9.7 The 1,543 schools becoming specialist in Phase 3 were the basis of the extensive comparisons of physics provision, participation and performance at GCSE and A-level in Chapters 2 to 7. During that period 749 schools remained non-specialist so they can be compared with the specialist schools as a group to complete the physics story. Chart 9.6 shows that pupils going to non-specialist schools will have had less chance of taking the GCSE or A-level and they tended to get poorer results when they did have that opportunity. Only half as many non-specialist schools as specialist schools offered GCSE physics (18.4 per cent against 36.4 per cent). When the opportunity was available the pupils were just as likely to take the subject, but their results were less good. Pupils in the non-specialist schools were also less likely to be able to take A-level physics and again their results were poorer. These findings for physics are consistent with the other findings for Phase 3 schools reported in Charts 9.3, 9.4 and 9.5.

Chart 9.6: Physics in Non Specialist Schools

Variable		Non Specialist			Specialist		
		N	Yes	%[1] or Mean[2]	N	Yes	%[1] or Mean[2]
GCSE Physics							
Provision	(Yes/No)	749	138	18.4	1,543	561	36.4
Participation	(% Entries)	138		14.0	561		14.1
Performance	(% A*/A)	138		30.9	561		33.9
A-Level Physics							
Provision	(Yes/No)	278	210	75.5	855	734	85.8
Participation	(% Entries)	210		8.4	734		8.9
Performance	(% A*/A)	210		17.4	734		20.1

1. Percentage of schools with courses in GCSE and A-level physics.

2. Means on participation and performance variables.

Résumé

9.8 The non-specialist schools differed markedly from the specialist schools, treated as a group, on intake, school characteristics and performance. The unfolding of the specialist schools policy was examined by comparing four periods. The specialist schools added more value than the non-specialist schools and the longer a school had been specialist the higher its value added appeared to be. The Specialist Schools and Academies Trust has interpreted results such as these as a vindication of the specialist schools policy. But our analyses also clearly show that each wave of specialist schools was drawn from a significantly weaker pool.

9.9 Pupils going to non-specialist schools have less opportunity to take GCSE physics and those who do take it are less likely to obtain an A*/A grade. Pupils in these schools were also less likely to have A-level physics available to them and those taking the subject were less likely to get an A grade. As we saw in Chapters 2 to 7, not only are there considerable differences between specialist schools, but the non-specialist schools do worst of all. The opportunity to study physics depends very much on the school attended.

10. Reasons for Choice of Specialism

10.1 The quantitative analysis is clear. Science schools have increased the opportunity to study physics for GCSE, but take-up is mainly driven by gender, and results by ability. The obligation on science schools to offer GCSE physics has not so far raised participation at A-level. There are big differences between specialist and non-specialist schools, but this is mainly because poorly performing schools are debarred from becoming specialist. There is little evidence of specialisation *per se* giving a boost to education. Nevertheless, the great majority of schools have applied to become specialist.

10.2 In this chapter we explore through the headteachers' own words how they came to choose the specialism they did and what benefits they perceive. In the summer term of 2008 letter was personally addressed to the headteachers of the 419 schools that had science among their specialisms. For comparison, letters were sent to schools with very good results in science at GCSE that might have become science schools, but chose another subject (at this point in the research we were assuming that only high performing schools in science would want to become science schools). We had originally intended to write to the top 419, but tied ranks took us up to 481 (see Appendix A). The letter was accompanied by a single sheet which, in the case of science schools, asked: 'Why did your school apply for Science Specialist Status?' (Three said they hadn't which shows that government databases are not always entirely accurate.) A second question was: 'What benefits has Science Special status brought to (i) to the sciences (ii) to other subjects and (iii) more generally throughout the school? A parallel version was devised for schools with other specialisms.

10.3 Altogether 247 usable replies were received: 62 from schools with science as the sole specialism, 17 with science as the main specialism, 33 with science as a second specialism and 135 with specialisms other than science. As in the numerical chapters, we have defined a science school as one having the subject as its sole or main specialism, and so the 33 responses from schools where it was a complementary specialism have not been included. Chart 10.1 presents a content analysis of the reasons given for choice of specialism. The 79 science schools put forward 225 reasons between them, and the 135 schools with other specialisms, 353.

10.4 The reasons given across the specialisms were very similar. In both science schools and schools with other specialisms the most frequent response was that the school was already strong in the subject. But, in the case of the sciences schools, close behind to our surprise came that the school was weak in the subject and saw specialist status as a lever to improve. Thirdly from the science schools was direction from the local authority or the Specialist Schools and Academies Trust to achieve, as far as possible, a spread of specialisms within the locality. They had been told that a balance of specialisms is important and 'you are more likely to achieve specialist status if you apply for this subject'. Some of the responses were unique to subjects other than science. In particular, 15 percent from 'other specialisms' referred to the subject being chosen so as to support the whole curriculum, making it the second most popular response. The subjects often mentioned in this regard were performing arts, technology and sports.

Chart 10.1: Reasons Given for Choice of Specialism

Reasons		Science School (79)[1] N[2]	%	Other Specialism (135) N[2]	%
A.	Strong in Subject	57	25.3	88	24.9
B.	Lever to Improve in Subject	42	18.7	42	12.0
C.	Strategic Distribution	20	8.9	35	9.9
D.	Renew Facilities	19	8.4	20	5.7
E.	Core Subject	17	7.6	11	3.1
F.	Links Other Schools	14	6.2	10	2.8
G.	Regional Regeneration	14	6.2	8	2.7
H.	Gender of Pupils	10	4.4	12	3.4
I.	Outreach to Local Community	10	4.4	12	3.4
J	More and Better Staff	7	3.1	2	0.6
K.	Enhance Status	6	2.7	3	0.9
L.	Opportunities for Pupils	5	2.2	9	2.5
M	Appeal to Parents	4	1.8	11	3.1
N.	Support Whole Curriculum	-	-	53	15.0
O.	International Links	-	-	13	3.7
P.	Only Option Available at Time	-	-	12	3.4
Q.	Complementary Subject	-	-	12	3.4
Total		225	100.0	353	100.0

1. Number of schools.

2. Number of reasons.

10.5 Beyond the main responses a wide variety of reasons was put forward. Chief among them was the extra money to renew facilities either in the subject area or across the school. Some schools mentioned the gender of the pupils either because the subject was appropriate (eg science for boys) or to challenge stereotypes (eg science or engineering for girls, or performing arts for boys). Whereas science was sometimes chosen as a core subject that would enhance status, other specialisms were more frequently about the relationship to the whole curriculum. Links to other schools, industry, the local community and internationally were also mentioned. In the case of schools that applied during the early years of the programme, technology was the only option available.

10.6 In Chart 10.1 the responses are given short labels and these do not always convey the richness of meaning. In the following boxes an example response for each category is given, in Box 10.1 for science schools and in Box 10.2 for other specialisms. They are each identified by the letter assigned in Chart 10.1. The four responses given by the ‘other specialist’ schools, but not by the science schools are illustrated in Box 10.3.

Box 10.1: Reasons for Becoming Science School

A. *"School already had an excellent science department with 18 teachers and superb results. We wanted to move to the next level."*
Voluntary Aided, Coed Comp, 11-18, Yorks & Humb

B. *"Science was a weakness in the college falling way behind the other core subjects at KS3 and GCSE. Two new senior staff provided the expertise and ideas to transform the science area and the specialist schools programme provided a focus and finance to make the transformation and improvements."*
Foundation, Coed Comp, 11-18, East

C. *"The school engaged in a discussion with the LA and other headteachers to ensure a breadth and balance of provision was provided across the city."*
Voluntary Aided, Coed Grammar, West Midlands

D. *"Science has been a strength in the school for some years. The accommodation however has been falling apart and so it was a way of injecting some much-needed funds into the dept."*
Voluntary Aided, Coed Secondary Modern, 11-18, South East

E. *"As a college in a deprived, ex-mining area we wanted a specialism in a core curriculum area, with academic status, rather than a foundation subject, hence science."*
Community, Coed Comp, 11-18, Yorks & Humb

F. *"We wished to develop as a centre of excellence for science and wished to support our feeder primary schools in the delivery of science at KS1 and 2."*
Voluntary Aided, Boys' Comp, 11-18, South West

G. *"Regional Development Agency's strategy which highlighted science as a means to economic regeneration."*
Community, Coed Comp, 11-18, North East

H. *"It was appropriate given the importance of science (and mathematics) in this boys' selective school."*
Foundation, Boys' Grammar, East

I. *"Richer learning experience for our students' focus for community development."*
Voluntary Aided, Girls' Comp, 11-18, South East

J. *"By taking on the science specialism we hoped to retain good staff and attract others to the department."*
Community, Girls' Comp, 11-16, East

K. *"To raise the profile of the department within the school and standing of the school in the locality and within the county."*
Community, Coed Comp, 11-16, East

L. *"We wanted to adopt 'heavyweight' subjects like science and maths (second specialism) since we knew these subjects would have a high currency for our pupils' future opportunities."*
Community, Coed Comp, 11-16, North West

M. *"A number of governors and parents are in science based industries."*
Community, Coed Comp, 11-18, North West

Box 10.2: Reasons for Becoming Specialist School

A. *"Performing Arts had a long history of success in the school in terms of its examination performance, enrichment activity provision and community work."*
Performing Arts, Voluntary Aided, Coed Comp, 11-16, South West

B. *"MFL dept very run down, staff instability, poor resources, complaints, results had deteriorated. Applied from a position of weakness with the intent to enhance provision in this area."*
MFL, Foundation, Coed Grammar, Yorks & Humb

C. *"Proposed to us by the LA in order that a network exists in the locality."*
Sports, Voluntary Aided, Coed Comp, 11-18, South East

D. *"Considered a centre of excellence although facilities quite poor. Seemed a perfect opportunity to gain funds for capital investment."*
Performing Arts, Community, Coed Comp, 11-18, North West

E. *"We decided to go for technology because it covered three lead subjects D&T, maths and science. These were already core subjects and so we felt this specialism would have the most impact on the largest number of pupils."*
Technology, Community, Coed Comp, 11-16, South West

F. *"Our aim was to extend the good practice across the school and into the wider community including all our feeder schools and post-16 providers."*
Humanities, Community, Coed Comp, 11-16, East

G. *"We have a company which provides jobs and training for local people in an area of high deprivation and unemployment. Our social enterprise was clearly the deciding factor, along with the need for regeneration in our community."*
Business & Enterprise, Voluntary Aided, Coed Comp, 11-16, North West

H. *"We were keen to broaden the awareness of engineering-related, high-powered careers at a time when there is a national shortage of engineers and in particular women engineers."*
Engineering, Foundation, Girls' Grammar, Outer London

I. *"We wanted a specialism which would build on our community identity and decided sport was the most appropriate."*
Sports, Foundation, Coed Comp, 11-18, West Midlands

J. *"A further consideration was the need to attract maths and ICT teachers. We had not had a full complement trained in teaching these subjects for years."*
Maths & Computing, Community, Girls' Comp, 11-16, East

K. *"We have strong creative arts and PE depts but we decided that choosing MFL sent out the right messages to parents about the school."*
MFL, Community, Coed Comp, 11-18, North East

L. *"On the basis of our strength and from a desire to open up every opportunity for the girls it was decided that engineering would be an excellent specialism for us. We aim to challenge gender stereotypes and encourage girls to take leading roles in their professions."*
Engineering, Foundation, Girls' Grammar, Yorks & Humb

M. *"It was felt that parents would support the specialism as we are essentially a sporting town."*
Sports, Foundation, Coed Comp, 11-18, East

Box 10.3: Reasons Given By Specialist Schools But Not Science Schools

N. *"The school had always valued the contribution of the arts to a child's education and their potential to raise achievement and contribute in developing the 'whole child' in terms of team players, confident individuals, reflective learners etc. "*
Performing Arts, Voluntary Aided, Girls' Grammar, Inner London

O. *"We wanted to keep languages alive, as we are part of Europe - and now Asia. To broaden the horizon for pupils as we look to a multicultural UK."*
MFL, Voluntary Aided, Girls' Comp, 11-18, North West

P. *"Initially technology was the only specialism on offer so we had no choice."*
Technology, Voluntary Aided, Coed Comp, 11-18, Yorks & Humb

Q. *"We sought a 'non-academic' subject thereby ensuring no subject was perceived to be any more important than any other. In essence, it was my decision as headteacher, after discussion with the head of PE, and we 'sold' it to the community. As a high achieving school the decision did raise some eyebrows."*
Sports, Foundation, Girls' Comp, 11-18, North West

10.7 It is clear that the motivations of the schools are similar across the specialisms with the main difference being that decisions were taken about science in its own right, but in the case of some other subjects it was what they could do to support other subjects or contribute to the overall ethos and development of the school. Even these verbatim comments do not convey the full flavour of what the headteachers were saying, because inevitably to fit into the boxes they have to be brief. In the next few paragraphs we allow the space for more extensive explanations.

10.8 The main polarity to emerge in the responses was between the schools that had chosen their specialism from a position of strength and those that had chosen the subject because they were weak in it and wanted a means to improve. This offers an important insight as to why, when the schools are treated as subject groups as in our quantitative analyses, the specialist science schools do not always emerge as the clear leaders in the field. The sharp contrast can be seen in the headteachers' personal accounts.

Science Chosen from Strength

Science and maths teachers represented over a third of the teachers in the school so this specialist area involved the greatest number of staff. Results, achievement, Oxbridge success already very high in science and maths - so we were playing to an existing strength (Foundation, Boys' Grammar, Outer London).

We applied for science status principally because of the excellent performance of the science department in SATs and GCSEs over at least the last ten years. It sets and achieves the most challenging targets. We also perceived the benefits in kind to the school, the department and the community. (Voluntary Aided, Coed Comp 11-16, East).

The science department was (is) a particularly strong department with consistently high examination results which contributed substantially to overall school results. Science is also popular at A-level (Voluntary Aided, Coed comp, 11-18, Outer London).

Science Chosen from Weakness

We are a large inner city girls' comprehensive. Science results were poor - it was the weakest of the three core subjects and I wanted to improve/raise standards in science as well as challenging stereotypical career choices made by many girls who were under-aspiring (hair and beauty, childcare etc). (Community, Girls' Comp, 11-16, North West)

At the time all schools in the area had applied for a specialism and it was felt we needed to do the same. Science was chosen because, not only was it not done by other schools, but it was also an area of weakness in the school. Funding was required to improve its delivery (Foundation, Coed Comp, 11-16, South East).

We needed to become a specialist school to obtain funding for capital build as we had terrible buildings. As a high achieving grammar school adding value is far harder. We were advised to choose the weakest department as the impact would be greater, hence science and maths (Foundation, Girls' Grammar, South West).

10.9 The main difference between science and other schools was that some of the other specialist subjects had been adopted as a vehicle for general improvement. Performing arts was frequently cited.

Performing Arts as a Vehicle for General Improvement

We wanted a specialist subject area that would influence every other subject area within the school. We believe the Arts to be an area that can give confidence, self-esteem, leadership and team-work skills to not only young people but to teachers as well. With a view to creating a school of independent learners, the Arts seemed like a very good choice (Voluntary Aided, Coed Comp, 11-18, East).

I had a great interest in the performing arts and the capacity for inclusion and opportunities for extra curricular provision. Our motto for performing arts is ' all to engage, many to shine and some to reach the stars'. In my view the only other specialism with this capacity is sport - another great interest of mine. Sport and Performing Arts hit the heart as well as the head and give pupils many opportunities to have their chance in the spotlight (Community, Coed Comp, 11-18, North West).

10.10 In some cases the general support to the curriculum sort was in the form of money. A school in the South West was quite frank about this. Technology was adopted not as a specialism but as a chance to update the equipment in all departments.

Specialist Status as a Way of Bringing in Extra Money

We had originally thought about applying for language college status in 1996, but we were daunted by the hurdles and the prospect of having to raise £100,000. We then received a fax offering to raise the money on our behalf for a payment of £10,000. We went for technology because it was easier and because we did not see it as a specialism - rather it was a chance to equip all depts with up-to-date resources (Technology, Foundation, Coed Comp, 11-18, South West).

I would like to make it clear that a great part of our reason for pursuing specialist status was because it would bring in extra money: as a rural school in a low-funded authority, we did not have access to any extra sources of funding in the way that urban schools did/do. You may be disappointed that I have not mentioned an improvement in standards of achievement/attainment, but I cannot impute our steadily improving standards uniquely to specialist status (MFL, Community, Comp 11-18, Yorks & Humber).

10.11 Our second question was: what benefits had the school received. Most schools referred to more than one and many schools said the same things. Altogether the 79 science schools put forward 528 benefits and the 135 schools with other specialisms, 681. Chart 10.2 presents an analysis of the replies.

Chart 10.2: Perceived Benefits of Specialist Status

Reasons		**Science School (79)[1]**		**Other Specialism (135)**	
		N[2]	**%**	**N[2]**	**%**
A.	Extra Funding	65	.3	0	13.2
B.	More Teachers and Better Recruitment	50	.5	9	5.7
C.	New Courses	48	.1	2	9.1
D.	Catalyst of Good Practice	40	.6	1	9.0
E.	Improved IT Provision	36	.8	1	9.0
F.	Enrichment Opportunities	36	.8	1	4.6
G.	School Partnerships	35	.6	6	6.8
H.	Raised Performance in Subject	28	.3	5	5.1
I.	Increased Participation Post 16	26	.9	3	3.4
J.	Improved Performance in Other Subjects	25	.7	3	6.3
K.	Raised School Morale and Expectations	23	.4	1	7.5
L	Subject Networks	21	.0	2	1.8
M.	Community Involvement	16	.0	6	3.8
N	Cross-Curricular Teaching and Initiatives	16	.0	8	2.6
O.	Business Links	14	.7	6	2.3
P.	Improved CPD	13	.5	7	4.0
Q.	Extra Support Staff	13	.5	4	2.1
R	Improved School Image	13	.5	4	2.1
S.	Enhanced Profile of Subject in School	10	.9	2	1.8
Total[2]		528	.0	1	100.0

1. Number of schools.

2. Number of reasons.

10.12 The most popular response for both science schools and other specialisms was the extra funding. But whereas the second most important perceived benefit to the science schools was 'more teachers and better recruitment', this was less of an issue for the other specialisms. For them second to funding was the wider range of courses they were able to offer. This was the third most frequently mentioned by the science schools, principally in relation to the introduction of triple science. Tied third for the other specialisms were the designated subject as a catalyst of good practice and improved IT provision (often associated with technology or engineering as the specialism). Box 10.4 illustrates with a verbatim comment each of the categories of Chart 10.2 for the science schools, and Box 10.5 offers a parallel set of exemplars for the other specialisms.

Box 10.4: Benefits of Becoming Science School

A. *"Improved resources and funding. The science college grant has meant that more resources can be allocated to other subjects. We consciously do not want to diminish the strength of arts and humanities in our curriculum."*

Community, Coed Comp, 11-18, Outer London

B. *"It has made it easier for us to recruit. We have three qualified physics specialists."*

Community, Coed Comp, 14-18, East Midlands

C. *"Triple science at GCSE has been successfully introduced. A-levels in chemistry and physics have been added, plus A-level further maths, GCSE statistics and a range of ICT qualifications."*

Foundation, Coed Comp 11-18, East

D. *"More sharing of good practice in T&L, tracking and target setting."*

Voluntary Aided, Coed Comp 11-16, North West

E. *"Ongoing funding has supported significant improvements in ICT across the curriculum. All classrooms now have an interactive whiteboard and this too has raised the standard of teaching and learning."*

Foundation, Girls' Grammar, East

F. *"Extended extra-curricular opportunities, eg science days, visits, competitions and stronger links with HE."*

Voluntary Aided, Boys' Comp, 11-18, South West

G. *"Primary schools visit throughout the year - now in excess of 20 lessons in science alone compared with one or two previously."*

Foundation, Coed Comp, 11-18, East

H. *"Improved examination performance in science at KS3 and KS4. It is now the strongest core subject."*

Community, Girls' Comp, 11-16, North West

I. *"Increased uptake post-16 eg 28 taking AS physics, 54 AS maths."*

Foundation, Coed Comp, 11-18, East Midlands

J. *"Maths (which comes with the science specialism) has also shown great improvement at every level."*

Voluntary Aided, Girls' Comp, 11-16, East

K. *"School has a 'feelgood' factor - virtuous circle with better environment, biddable children and highly motivated teachers."*

Voluntary Aided, Coed Comp, 11-18, Yorks & Humb

L. *"Involvement in national activities such as the STEM Access project."*

Community, Girls' Comp, 11-16, East

M. *"Greater community involvement in school activities."*

Foundation, Coed Comp, 11-18, East Midlands

N. *"Many other subjects have engaged in cross-curricular projects, even those with less obvious links such as history and English."*

Foundation, Boys' Grammar, East

O. *"Local and national businesses have helped with a college racing car which has seen students working on the car after school, visiting specialist manufacturers and sponsors, as well as being pit crew at race meetings throughout the UK."*
Foundation, Coed Comp, 11-18, East

P. *"Funding of CPD such as the development of master classes has come directly from the science specialism."*
Community, Coed Comp, 11-16, South East

Q. *"More staffing including technicians and TA support enabling us to offer more courses, including AS Science and OCR Science Nationals."*
Foundation, Coed Comp, 11-16, South East

R. *"Confidence of the community, teachers and pupils raised after long period spent in Special Measures."*
Community, Boys' Comp, 11-16, Outer London

S *"Science profile raised within school (investment in hardware, software, staff development) all have given the subject higher status."*
Voluntary aided, Coed Comp, 11-16, North West

10.13 Consistent with the aim of giving support throughout the school, which was often given as a reason for adopting the subject by other specialisms, but not by the science schools, 'improved performance in other subjects' and 'raised school morale and expectations' were more often mentioned as benefits by those schools. They were also more likely to refer to improvements in professional development. As in the analysis of the stated reasons for adopting a specialism, an illustrative response is provided for each category. Box 10.5 gives the responses of the science schools and Box 10.6 those of the other specialisms. Interestingly, the other specialism schools wrote more, so that although one example is provided for each response category, the box for the science schools is shorter. But the verbatim responses convey the broad similarity of the benefits arising from becoming a specialist school irrespective of subject.

10.14 Both science and other specialist schools frequently mentioned being able to provide a wider range of courses. For languages schools, it was the opportunity to offer more languages and from an earlier age. But for the science schools it centred on the introduction of triple science which we picked up on in the quantitative analysis of Chapter 2. This is something the science schools have been required to provide from September 2008, and it came through time after time.

GCSE Triple Science Provision

For the most able, have replaced AS for Public Understanding with the separate sciences beginning in Year 9. Results in science improve year-on-year with improved uptake at KS5 (Community, Coed Comp, 13-18, Yorks & Humb).

We have condensed KS3 to two years and start GCSE science in Year 9. Take-up of triple science has greatly improved resulting in more A-level students. Results in triple science have improved, and at A-level they have risen across the board (Community, Coed Grammar, South East).

Box 10.5: Benefits of Becoming Specialist School

A. *"Additional resources have improved T & L facilities in the specialist subjects. These have included improved classroom environments, additional materials and extensive ICT investment."*

Humanities, Voluntary Aided, Coed Comp, 11-18, North East

B. *"Extra teaching staff in the dept has enabled us to offer more languages with a significant number of students compared to national figures studying two languages."*

MFL, Voluntary Aided, Coed Comp 11-16, Inner London

C. *"It has enabled us to diversify even further our choice of languages and the age at which we can offer them: we now offer French, German, Spanish, Russian, Mandarin and Japanese. MFL is retained as a compulsory subject in Key Stage 4."*

MFL, Community, Coed Comp, 11-18, Yorks & Humb

D. *"Performing arts fully embedded across the curriculum. All subjects use it to support learning. This has led to an increased variety of L&T styles, and lessons are more fun. Pupils more confident, can talk well in public and present well."*

Performing Arts, Voluntary Aided, Girls' Comp, 11-18, Inner London

E. *"The impact of technology has been felt throughout the curriculum, as the school has pushed technology as a learning aid in most subjects."*

Technology, Foundation, Boys' Comp, 11-18, East Midlands

F. *"Enhanced curriculum offer, for example, pupils working with professional artist, workshops, master classes. There are also extended extra-curricular opportunities including a variety of clubs, theatre trips, museum and gallery visits."*

Performing Arts, Voluntary Aided, Girls' Comp, 11-18, Inner London

G. *"Expertise and INSET shared with primary colleagues leading to improvements in the quality of T&L at KS2."*

Technology, Voluntary Aided, Coed Comp, 11-18, South West

H. *"Hugely increased numbers and better results in drama."*

Performing Arts, Community, Coed Comp 11-18, East

I. *"Marked increase in uptake of science at A-level - 2 groups for physics as well as for chemistry and biology. GCSE Engineering has become such a success that GCSE Product Design is now in decline. More girls are considering engineering degrees. There has been a reduction in girls wanting to become medical students with more considering medical engineering."*

Engineering, Foundation, Girls' Grammar, Yorks & Humb

J. *"Our D&T used to be a disaster area, now it is superbly equipped and highly successful (85% A-C at GCSE). Maths and science have also benefited, particularly from ICT resources and training."*

Technology, Foundation, Coed Comp, 11-18, South West

K. *"It has produced a 'feelgood' factor, which has inspired staff and pupils to achieve high standards. Confidence has been raised in both pupils and staff."*

Technology, Voluntary Aided, Girls' Grammar, North West

L. *"As a girls' highly selective school, building a positive national reputation was a challenge - we had more detractors than supporters! Becoming a specialist school and engaging in all SSAT ventures and networks, we have become recognised as an innovator and a significant institution in national development and research."*

Engineering, Foundation, Girls' Grammar, Outer London

M. *"Having a specialism has made the school engage much more with the wider community: supporting T & L in particular schools, liaising with local charities and institutions, and working with the LA and the borough council to become a major partner in the Arts strategies of these bodies."*

Performing Arts, Community, Coed Comp, 11-18, East

N. *"Links across subjects are strong. Performing Arts works closely with languages (eg German/French pantomime) and there are paired observations throughout the school."*

Performing Arts, Community, Coed Comp 11-16, West Midlands

O. *"It has made us connect with our local community and employers. An 'Employers' Forum' has been created which has established excellent relationships that have resulted in local businesses coming in to school to work with teachers, pupils and the curriculum"*

Engineering, Voluntary Aided, Boys' Comp, 11-16, Yorks & Humb

P. *"CPD opportunities through the 'Improving Learning Group' to promote best practice in the combined use of Thinking Skills, Assessment for Learning and New Technologies. This INSET programme of the last three years has been adopted as a model for secondary schools in the LA."*

Humanities, Voluntary Aided, Coed Comp 11-18, East Midlands

Q. *"We have been able to employ additional non-teaching staff to support learners and teachers: a web designer; a learning methodologies manager (both qualified and highly skilled graphic designers); and additional technicians."*

Technology, Community, Coed Comp 11-18, North West

R. *"Many parents like the fact that we have a Maths specialism (not so much the Computing), therefore it does attract some - hence a marketing benefit."*

Maths & Computing, Voluntary Aided, Boys' Grammar, West Midlands

S. *"Greater recognition for the excellent work undertaken in sport and a further boost to development in this area. Status enhanced within a largely academic school."*

Sports, Foundation, Coed Comp 11-18, West Midlands

GCSE Triple Science Provision (continued)

We have been able to enhance staffing and introduce triple science in Years 10 and 11, giving a better basis for sixth form science A-levels. Groups for these are very healthy, and we have a number of students applying to university each year for medicine, engineering, natural sciences, chemistry, biology, etc (Voluntary Aided, Boys' Comp, 11-18, Outer London).

There have been massive changes and benefits to science and mathematics. New subjects have been introduced such as A-level Human Biology, Geology, GCSE triple science. Wider participation, smaller set sizes, with extra support for the less able (Foundation, Boys' Grammar, East).

10.15 There is also the flavour in these responses of improved participation and performance post-16, but this did not show up in our analyses in respect of physics in Chapters 6 and 7, though it could have been in other science subjects. Most of the responses we received were highly positive and we had a sense at times that the schools were singing from a specialist schools' song sheet, so it was interesting to have also received some more critical comments. The common theme here was that the money had brought benefits and that some good ideas had emerged, but there were doubts whether this had much to do with the subject specialism itself.

Critical Comments Regarding Benefits.

Specialist status did NOT bring benefits - rather it was a lever for change with some funding to support. It gave us a reason/justification for changing a traditional school. A different/similarly funded initiative would have worked as well. The Specialist Schools and Academies Trust undermines itself by its own propaganda in suggesting that specialist status brings intrinsic benefits. It does bring benefits, but as a school improvement programme, not because of specialisms (Science, Community, Coed Comp, 11-18, West Midlands).

The Specialist Schools and Academies Trust self-importantly claims all improvements are due to specialist status. Some good ideas came out of it, but when will anybody have the courage to say 'the Emperor has no clothes' (Technology, Community, Coed Comp 11-18, North West).

Résumé

10.16 The main reason for adopting a particular subject put forward by science and other specialist schools was their strength in it. But, interestingly, the second most popular reason for science schools was their weakness and specialist status as a means to improve. Third, was being directed to the subject for strategic reasons. These also appeared in the top four for other specialisms, but intervening here in second spot was choosing a subject, like performing arts, technology or sport, to support the whole curriculum.

10.17 The main benefit perceived to have been obtained from specialist status was the extra funding. In the case of science schools, better teacher recruitment came next, but this was less of an issue for the other specialisms. The science schools and the others were, however, similar in seeing the introduction of new courses as a major benefit - in science schools, triple science. Consistent with other specialisms being chosen to support the whole curriculum, these schools tended more often than the science schools to refer to catalysing good practice, improving IT provision, raising school morale, improved performance in other subjects, and better CPD.

11. Is School Specialisation Boosting Physics?

11.1 The evidence of this report is that specialist science schools have increased the availability of GCSE physics, and entries per school have held up across the broader range of schools. This has led to an increase in total take-up and contributed to the swing back to the separate sciences. The science schools are also among those obtaining the better GCSE physics results. There is a correlation between GCSE physics and A-level physics entries, and science schools were among those getting the higher A-level grades. According to the schools, specialist science status had brought major benefits in terms of funding, staffing and being able to mount a wider range of courses, not just triple science, but also others at Key Stage 4 and in the sixth form. More generally, specialist schools appear to add more value than non-specialist schools, and the longer a school has held specialist status the more value it seems to add. Does this mean then that the specialist schools policy has been a great success and boosted school standards?

11.2 It has certainly had a great impact. A comprehensive system has been transformed with the vast majority of schools now identifying with a particular subject or subjects. But closer examination of the evidence raises a number of questions. Have the changes been entirely beneficial? Would an injection of the same amount of money into another programme have produced the same or better results? Are specialist schools really more effective than non-specialist schools? Before offering our answers we review the evidence of this report in relation to specialist status, school performance and value added.

Specialist Status

11.3 A difficulty in being confident that specialist status *per se* is the key to school improvement is that it is hard to be sure exactly what it is. As we have seen, the policy has been made on the hoof. Kenneth Baker saw it as creating a new kind of school. Cyril Taylor used it to rescue both the city-technology-college concept and technology in the national curriculum. Tony Blair adopted it as his answer to 'bog-standard' comprehensives and morphed it into a general school improvement programme. Gordon Brown is seeking to use it to drive up triple science entries and win acceptance for the diploma. It is also essentially an urban policy. Where there is a range of possible specialisms available locally, conceivably a parent might want to make a choice between them on the basis of specialism. But in rural areas and small towns it is almost certainly Hobson's choice. If the only reachable school has decided to go for science or languages, or performing arts, or sport, and you don't think this is the specialism for your son or daughter then that's your bad luck.

11.4 If a specialist school was what it said on the tin, then anyone advising parents would surely encourage them to send a child with a scientific bent to a science school, and likewise a sporting talent to a sports school. But we know from what the schools told us in the survey that they didn't always choose science or sport because of their strengths in these fields. Some schools told us that they had chosen science because they were weak at it and wanted to improve or that they had been directed to adopt the specialism for the sake of balance in the locality. A school told us that it had become a sports school because, "we sought a 'non academic' subject thereby ensuring that no subject was perceived to be any more important than any other". Another said, "we went for technology because it was easier and we did not see it as a specialism - rather it was a chance to equip all departments with up-to-date resources".

11.5 There is no reason, therefore, to suppose that the school would be a centre of excellence in its specialism. Indeed, the government has discouraged the notion stressing that specialist schools should provide a high quality education across the curriculum. Neither has it allowed specialist schools to select on the basis of ability in the subject, though some specialisms, for example sport and technology, are regarded as aptitudes, and in these fields selection of up to 10 per cent of the intake is possible (though rarely implemented). Stamping on selection is logical from a Labour standpoint since to allow specialist schools to recruit on ability would mean an even more narrowly based selection process at age 11 than was the case under the grammar school system. On the other hand, the government is requiring the science schools to offer particular courses and the extra funding is enabling them to recruit scarce science teachers. A school told us that the major benefit of specialist status is that: "It has made it easier for us to recruit. We have three qualified physics specialists". A likely outcome of the specialist schools policy is that the secondary education system will become more differentiated, but the diversity will not be in response to different talents and degrees of talent, but rather reflect extraneous social characteristics.

School Performance

11.6 The performance of the specialist science schools is generally strong in both GCSE and A-level physics. But this is a reflection of their intakes. Broadly speaking, the specialist schools fall into two main groups: the 'academic' (science, maths & computing, languages, humanities and music) and the 'practical (performing arts, technology, engineering, business & enterprise, and sport). The first group differ from the second on all intake measures - prior attainment, eligibility for free school meals, special needs whether statemented or supported - and all outcome measures including GCSE and A-level physics attainment. As a member of the academic group the results of the science schools are good, but not the best. Among the non-selective schools it was the music schools that achieved the best results in A-level physics in 2007 followed by the languages schools and maths & computing, and only then science. Intake differences fell into this pattern also.

11.7 The effects of intake show up even more sharply when grammar schools and non-selective schools are compared. The grammar schools, irrespective of specialism, were twice as likely to achieve A*/A in GCSE physics as non-selective schools (68.4 per cent against 34.6 per cent), and nearly twice as likely to get a top grade at A-level (37.2 per cent against 21.0 per cent). Not surprisingly, the grammar schools more frequently opt for academic specialisms. The three factors that predicted with 72 per cent accuracy the likelihood of a school having GCSE physics entries were: science school (where provision is now obligatory); grammar school; and boys' school. The uneven distribution of grammar schools across the specialisms tends to bias the analysis, so much of this report is confined to the non-selective schools (supposedly academically non-selective, but as the intake differences show clearly selective in some way).

11.8 Among the non-selective schools, the nature of the intake is more indicative than school specialism of GCSE and A-level physics participation and performance. Gender is strongly related to take-up of both GCSE and A-level physics. It was, however, unconnected with performance: boys tend to get somewhat better results in GCSE physics, but it is girls who come out on top at A-level, presumably because they are highly self-selected. But the major determinant of take-up and performance at both levels is prior attainment - which encompasses both ability and motivation. The most prominent variable in GCSE physics take-up is Key Stage 3 science results, which is not surprising since the entitlement to study GCSE physics only comes into effect for pupils who achieve at least a Level 6. Participation in A-level physics can be predicted from participation in GCSE physics and general attainment at GCSE, as well as from gender. The only strong link to A-level physics performance was found to be five good GCSEs (though academic specialism also makes a near significant contribution). General GCSE attainment in this respect is probably best regarded a summary of the intake differences and differential effectiveness of schools.

11.9 The science schools do have good take-up and performance in physics, but it seems fairer to conclude that this owes more to intake and other differences than specialism. The schools offering GCSE physics when they had the choice tended to be those controlling their own admissions, having sixth forms, boys' schools and faith schools. The evidence points to the science schools achieving the results that they do, not because of their specialism but because of how they are perceived and who attends.

Value Added

11.10 Supporters of the specialist schools policy claim that it has led to improvements, both specifically in the named subject, and more generally across the school. This assertion of greater effectiveness rests on calculations of value added between two points in time. Among the variables supplied to us in the National Pupil Databases was a measure devised by the DCSF of contextual value added. This seeks to record differential improvement between Key Stage 2 scores and GCSE taking into account the social context. The scores are worked out for each pupil, but we have aggregated them into a school characteristic. And as we have reported, specialist schools add more value than non-specialist schools and the longer a school has been specialist the more value it adds. Ergo: the specialist schools policy has worked.

11.11 Well, possibly, but our results also show close links between school characteristics and the nature of the intake, and it may be that contextual value added - a performance measure - is not completely independent. It could be that some schools are admitting pupils who are easier to teach and, although the measure seeks to allow for this, it may not be entirely successful. What is striking is the way the specialist schools have been creamed off from a progressively weakening pool of non-specialist schools. This happened from the outset when only the grant maintained schools were allowed to bid, but each successive round has come off the top of those remaining. This means that not only are the comparisons between specialist and non-specialist schools intrinsically unfair, but also that the earlier specialist schools were the more advantaged. If, as we suspect, the measure of contextual value added is bound up with intakes and school characteristics, these features may explain why the first specialist schools have the higher value added scores.

11.12 But it is also true that they will have enjoyed higher levels of financial support for longer. Extra funding was identified by the specialist schools as the major benefit. This has enabled them to appoint more and better staff, improve facilities, put on new courses, catalyse good practice and develop in a number of other worthwhile ways. It would be deeply disappointing if this extra investment had not had any return. But the question posed by some of our more sceptical respondents was: would a similarly funded but different programme have worked as well? Is it a case of 'the Emperor's new clothes'? As well as getting extra money the specialist schools were admitted to what was initially an exclusive club, the Specialist Schools and Academies Trust (SSAT) in its various guises. The schools were invited along to what were essentially revivalist meeting where beliefs were spread and faiths strengthened. Although the club has become less exclusive as the number of specialist schools increased, there is still in-group feeling. Until its wings were clipped recently, the SSAT had grown to become almost an alternative government department of secondary education. It continues to provide extensive support to its member schools through its website and in other ways.

Other Research

11.13 We are the first to study the impact of the specialist schools policy on physics, though Jesson and Crossley (2007) have looked at biology. Like us, they found that science schools were more likely to offer the subject, that the take-up was higher and that a higher proportion of pupils got a good grade. But they did not drill down for explanations and there is a growing body of work which has been subjecting the specialist schools policy to serious scrutiny. This is reviewed briefly here and more fully in Appendix C.

11.14 The early research commissioned by a predecessor of the DCSF and a predecessor of the SSAT, including work by Jesson, obtained results to delight the sponsors. Case studies of 12 specialist schools by Yeomans *et al* (2000) concluded the programme was "widely perceived as an effective and worthwhile initiative which had brought many benefits". Four years later the Department unashamedly commissioned research from the Institute of Education and the University or Warwick to identify "examples of best practice and the key components which make a specialist school successful". Not surprisingly, the search came up with a glowing list of benefits. The SSAT also commissioned the NFER to investigate the success factors underlying high performance in specialist schools. The researchers (Rudd *et al,* 2002) came up with nine, for example 'whole-school ethos', which in a later study (Judkins and Rudd, 2005) was extended to twelve, with the addition of 'collaboration with the community', 'staff confidence' and 'creativity and innovation'. To be fair, in substance, what the schools were saying was not very different from what they told us in Chapter 10. But Castle and Evans (2006) make the crucial point that apart from the extra money, "all other factors could be present in effective schools no matter what their status".

11.15 Jesson (2002a, 2003) and Jesson and Crossley (2005, 2006, and 2007) have attempted a quantitative assessment of the effectiveness of specialist schools. In 2003, Jesson reported that 54.1 per cent of pupils in specialist schools obtained five good GCSEs compared with 46.7 per cent in non-specialist schools. When it was pointed out that this took no account of intake differences, he turned to value added analysis and claimed that "specialist schools had a net value added of +4.5 compared with other schools". Jesson, at one time a member of the SSAT hierarchy, concluded that "these excellent results strongly vindicate the Government's decision to expand the number of specialist schools to at least 2,000 by 2006".

11.16 Jesson (2002a) has come in for some heavy criticism from Schagen and Goldstein (2002) who argue that his research fails on three counts: value added studies should be conducted on pupil level data; that sophisticated multi-level statistical techniques are required; and relevant contextual factors, like eligibility for free school meals are ignored. They also remind us that value added is taken into account in awarding specialist status, that the sponsorship requirement can be more easily met by middle class schools, and rather than specialist status increasing value added, the correlation could be because schools that added more value were more likely to qualify to become specialist. Jesson (2002b) retorted that the academic world "is full of 'Jeremiads' (*sic*) ready to demolish anything in education that appears to go well (especially if it is a government initiative)".

11.17 There are clearly pitfalls in value added research and some of Schagen's and Goldstein's criticisms could be levelled at the present study. We have aggregated individual pupil data to the school level, but this is because our units of analysis are the schools. We would argue that it is fair to characterise the schools in terms of, say, percentage eligibility for free schools or the average Key Stage 3 science scores of pupils. We have similarly used the aggregate contextual value added scores calculated by the DCSF from the performance of individual pupils as a school characteristic. We have not used multi-level modelling because we believe our methods have more simply and directly addressed our research questions and have come up with clear answers when sophisticated modelling can be hard to interpret. Schagen and Goldstein might not agree, but at least we meet their third point by incorporating eligibility for free school meals, and other intake and school variables.

11.18 At all events, the results we have reported are in accord with the multi-level analyses. Levacic and Jenkins (2004) found a small difference in added value between specialist and non-specialist schools which became smaller when only non-specialist schools with a high probability of becoming specialist were considered. They also found, as Noden and Schagen (2006) did, that there were differences according to the length of time a school had been specialist, but as we also conclude this is likely to be that the more effective schools were selected to become specialist in the first place. But whereas multi-level analysis has come up with only small and inconsistent differences between specialisms, our research has revealed a very clear pattern of differences between the groups that we have called the 'academic' and the 'practical', where the intakes, school characteristics, and outcomes are clearly distinguishable.

11.19 But this probably has little to do with their specialist status. Taylor, J. (2007) has pointed out that it is not possible to deduce whether specialist status of itself is producing improvements because it brings extra money. Mangan, Pugh and Gray (2007) found that school performance improved in response to increased funding, but by only a modest amount and it did not depend on acquiring specialist status. Castle and Evans (2006), in reviewing the evidence concluded, “the majority of specialist schools are highly effective”, but “whether this is due to their selection practices (overt and covert), or to being already highly effective in order to obtain specialist status is not clear”. To that we would add a third possibility which is that specialist schools could have benefited from the collective lift received from being a member of an in-group.

11.20 It may not be too much of an over-simplification to say that the sum total of research on specialist schools shows that good schools plus extra funding do better.

Conclusion

11.21 The specialist schools programme has been about much more than money, but it is debatable whether it has been entirely beneficial. It may have evolved into a general school improvement programme, a way of shaking up ‘bog-standard’ comprehensives; but it has left us with a secondary school system in which the great majority of schools have labels that do not appear to mean very much. What is a science school or a sports school supposed to be? Is a sports school expected to help us field a team for the 2012 Olympics? Are science schools to educate our future research scientists? But if they are not able to select on ability, how can they specialize in this respect?

11.22 If the labels don’t really mean anything then they are a trap for unwary parents. Should they send their children to what they instinctively feel is a good school or do they make every effort to find one with an appropriate title? If science schools are funded to offer more courses and recruit better teachers, and modern foreign language schools, more languages and more staff, then the schools will inevitably grow further apart. But someone with a talent for science may end up in a languages school and vice versa, so some children will have better opportunities than others to develop their particular abilities. We are where we are. Whatever the benefits of the specialist schools policy for individual schools, an urgent problem for government is the lack of shape to secondary education as a whole. It has to find ways of bringing together the present diverse mix of schools into a coherent system that provides equivalent opportunities for all children.

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Appendix A:

A.1 In order to investigate the part played by specialist science schools in physics provision, participation and performance, school level datasets have been compiled from the National Pupil Databases for 2002-03 to 2006-07 for all maintained secondary schools in England with pupils at least up to the age of 16. It consists of 76 discrete variables which could be coded in up to six different ways. Altogether there are 327 variables and variants. A full list of the discrete variables and an indication of the variants is given in Appendix B.

Compiling the Databases

A.2 The databases were assembled from three main sources:

- the National Pupil Database (NPD);
- 'EduBase', the register of all educational establishments;
- the School and College Achievement and Attainment Tables.

A.3 Anonymised data from the National Pupil Databases were released to us by the Department for Children, Schools and Families. A full and detailed listing of educational institutions was purchased from 'Edubase', which is run by DCSF. The School and College Attainment Tables are available for public access on the DCSF website. In addition, the dates when specialist schools became operational were obtained from the DCSF's Standards Website and from data published annually by the Specialist Schools and Academies Trust (SSAT). Eligibility for free school meals was obtained under the Freedom of Information Act.

The National Pupil Database

A.4 The NPD, which arose out of the 1998 School Standards and Framework Act, is intended to provide a single longitudinal record for each pupil in education in England. It holds pupil level data on attainment and pupil characteristics at each Key Stage, including by subject and grade at GCSE, and in post-16 examinations. These data can be aggregated to school level since the record for each pupil includes a school identifier, the Unique Reference Number (URN). Information on the type of school and LEA is also included.

A.5 The DCSF kindly provided us, for each of the five years 2002-03 to 2006-07, with the Key Stage 4 and Key Stage 5 (formerly known as sixth form) pupil level data files, plus other files listing the variables and giving the data definitions. The KS4 and KS5 files each contained anonymised information on over half a million pupils each year. The individual records were aggregated to the school level, since schools were to be our units of analysis.

The Register of Educational Establishments 'EduBase'

A.6 The aggregated NPD data file tells us a lot about a school's performance but information on the characteristics of the school is limited to the URN, the LEA and type of school by funding category. A fuller picture was obtained by including information available in 'EduBase', again by matching the school's URN in the working file with the URN in 'EduBase'. Variables added in this way included age range, gender, admissions policy, and religious character, and most importantly, from the point of view of the present project, the school's specialist status and subject. The school's URN in 'EduBase' also identifies the name of the school as well giving the LEA.

The School and College Achievement and Attainment Tables

A.7 With the school's URN now matched to the school's name we were able to turn to the DCSF's school and college performance tables at GCSE and Post-16 to complete the array of variables in the working Excel file. Using the school's name and LEA, further information on school characteristics such as the percentage of statemented and supported pupils with special needs, size of the sixth form, and the number of pupils at the end of KS4 and KS5 was extracted. The information on GCSE performance was also extended including, for example, time series data on the percentage of pupils in the school obtaining five A*-C, the percentage of pupils achieving functional English and maths at Level 2, the average uncapped GCSE points score, and the contextual value added score. At KS5 there was less scope for extending the database, but average A-level point score per student was added.

Other Data Sources

A.8 In order to assess the impact of specialism it is important to know how long a school has held that status. This information was obtained from the Specialist Schools' website, which is accessed via the DCSF's School Standards site. Although there are two bidding rounds during the year leading to designation, the operational date is set at 1st September, the beginning of the school year in question. The operational date was checked with the listing of the Specialist Schools and Academies Trust in its report on '*Educational Outcomes and Value Added by Specialist Schools, 2006 Analysis*' (Jesson and Crossley, 2006). Eligibility for free schools meals (FSM) was used as a surrogate for the socio-economic environment of the school and obtained under the Freedom of Information Act.

Secondary Variables

A.9 A further stage in constructing the analytical databases involved the creation of new variables derived from the data already entered in the working file. Secondary variables were calculated for each subject turning raw numbers of entries and grade achieved into percentages and average point scores: for example, the percentages achieving grade A*/A and A*-C at GCSE, and A grade at A-level. The accumulated working Excel file was then exported into SPSS for analysis.

Survey

A.10 Headteachers of all 419 schools which, in 2007, were shown as having science among their specialisms were sent a personal letter immediately after the summer half-term break, 2008. A comparable letter was sent at the same time to a sample of headteachers of specialist schools which did not include science among their specialisms. The letters asked if they would set down briefly on a proforma how the school came to choose its specialism(s) and what the benefits had been.

A.11 Schools with other specialisms were ranked in terms of a GCSE science score compiled by the DCSF. In practice we were not able to select the top 419 schools because of tied rank so the sample was allowed to run up to 481. Altogether 247 usable replies were received (24.7 per cent) with grammar schools, girls' schools, and foundation/voluntary aided somewhat more likely to reply. The proportion of schools responding was slightly higher for the non-science schools, 135 out of 481 (28.1 per cent), than for schools with the science schools, 112 out of 419 (26.7 per cent). Nearly half the science school replies (62) came from schools with science as the sole specialism, a further 17 where science was the main specialism and 33 where science was the second specialism. The majority of the respondents were the headteachers themselves.

A.12 With parallel versions for science schools and for other specialisms the proforma asked two questions: (1) why had the school adopted the specialism it had; and (2) what benefits specialist status had brought to the (i) specialist subject area (ii) other subjects and (iii) the school in general? Many of the respondents provided a detailed and comprehensive account, some including additional documentation, as part of their reply. A handful elaborated further in a follow-up telephone call.

Appendix B: List of Variables in Database

Identifiers

School Name
Unique Reference Number (URN)
Specialism
Year Designated
Region
Local Education Authority

Characteristics

Admissions Policy (Comprehensive, Grammar, Secondary Modern)
Type (Community, Voluntary Aided, Voluntary Controlled, Foundation)
Gender
% Girls in Key Stage 4
Religious Character (Secular, Church of England, Roman Catholic, Other Christian, Other Faith)
No of Students
No at end of Key Stage 4
% Eligible for Free School Meals
% SEN with Statements
% SEN Supported
Statutory Highest Age of Pupils
Sixth Form
No on Roll 16-18
No at End of Key Stage 5
No of Boys at End of Key Stage 5
No of Girls at End of Key Stage 5

General Educational Performance

Average Key Stage 2 Point Score (2001)
Average English KS2 Point Score
Average Maths KS2 Point Score
Average Science KS2 Point Score
Average Key Stage 3 Point Score (2004)
Average English KS3 Point Score
Average Maths KS3 Point Score
Average Science KS3 Point Score
Contextual Value Added from Key Stage 2 to GCSE
% 5 A*-C GCSEs including English & Maths (2006)
% 5 A*-C GCSEs or Equivalent
Average GCSE Point Score Uncapped
Average Point Score Per Student at KS5

GCSE Participation and Performance in Science

Highest Point Score Achieved in Science in 2006

Physics (5 variables for each subject)

- Entries in GCSE
- Per Cent Entries
- Average Point Score
- % A*-A
- % A*-C

Chemistry

Biology

Double Award Science

Single Award Science

Vocational Science

Maths

English

French

A-level Participation and Performance

No of A-Level Subjects Offered by School in 2005-06

Percentage of Total of A-Level Subject Categories

Physics (5 variables or each subject)

- Offered by School
- Entries
- Entries as % of Pupils at End of Key Stage 5
- Average Point Score
- % A Grades

Biology

Chemistry

Other Science

Psychology

Maths

Further Maths

Computing

Information Technology

Business Studies

Art and Design

Geography

History

Economics

Religious Studies

Law

Political Studies

Sociology

English
Expressive Arts
Media Studies
French
German
Spanish
Music
Physical Education
General Studies
Critical Thinking
Food

Appendix C: Literature Review

C.1 There is a growing body of research on specialist schools which we consider under the following headings: government-funded research, Ofsted studies, reports from the Specialist Schools and Academies Trust, differentiation in the school system, raising performance, value added, multi-level modelling, years specialist, extra funding, impact of policy.

Government-Funded Research

C.2 One of the earliest research projects was commissioned in 1998, four years into the specialist schools programme, by the Department of Education and Employment (the government's education department of the time). The project was in two parts, the first conducted by West *et al* (2000) and the second by Yeomans *et al* (2000). The first was based on a questionnaire survey of headteachers, heads of specialism and chairs of governing bodies of all 238 specialist schools operational in September 1997. The second and complementary study was based on case studies in 12 specialist schools. West *et al* (2000) reported from their questionnaire returns which were "broadly representative of all specialist schools" that eight out of ten headteachers were "very satisfied' with the programme".

C.3 A number of advantages were cited. The majority of headteachers and heads of specialism, though somewhat fewer chairs of governing bodies, pinpointed additional resources. The schools were popular with parents. Fewer than ten per cent of comprehensive schools used selection by aptitude in the specialist subject. Numbers of teaching and non-teaching staff had increased. More hours had been timetabled for specialist subjects. Pupil and teacher motivation had improved. Participation post-16 had increased. Outreach with primary and other secondary schools had been enhanced and links with sponsors and business established. Using raw examination results, the report identified improvements in GCSE examination results year-on-year in specialist compared with non-specialist schools. Increases in specialist subject entries per pupil were higher than for schools generally, as was the average GCSE points score for the specialist subject.

C.4 A minority of heads and heads of the specialist subject reported disadvantages, the main one being the extra workload. Governors raised the issue of the inequitable distribution of resources between departments. But the major concern among respondents (six out of ten) was about being able to meet their specialist school targets. Despite the positive feedback from the survey the authors commented that the research raises a number of questions about the future development of the programme in order to deliver the best possible improvements in examination performance for pupils.

C.5 The second of the two research projects, conducted by Yeomans *et al* (2000) through 12 case studies drew out the differences between schools by type of specialism according to their use of resources, staffing and staff development, curriculum changes and standards achieved. The report, echoing that of the survey, concluded that the programme was "widely perceived as an effective and worthwhile initiative which had brought many benefits". Development of partnership and community links was picked out as important for the future development of the programme.

C.6 Four years on the government's education department, now renamed the Department for Education and Skills, commissioned a further study of specialist schools this time from the Institute of Education and the University of Warwick (2004) which aimed to identify "examples of best practice and the key components which make a specialist school successful". As in Yeomans (2000), the preferred method was case studies. Eighteen specialist schools were selected, each of which was above average in terms of GCSE performance. Information was obtained through semi-structured interviews, face-to-face in the case study schools and by telephone with feeder and partner schools. To find out if the ethos of the school had changed as a result of specialist status a survey based on the 'School Conditions Scale' developed by Hopkins *et al* (1994) was administered to a cross-section of staff.

C.7 The report concluded that specialist status generated a range of benefits which the researchers categorised into four areas: "a strong reinforcing and positive effect upon school ethos; a powerful lever for school improvement and evidence to suggest that it is associated with raising academic performance; as 'Centres of Excellence' high quality professional development that is improving the quality of teaching and learning within the subject area in partner schools; and a positive effect upon partner secondary and primary schools and into the wider community".

C.8 Other researchers not funded by the government have been very dismissive of these findings. Taylor, J. (2007), for example, contends that conclusions based on such a small sample are "unlikely to produce reliable conclusions about the system as a whole". Furthermore, "findings based on schools which were performing above average, cannot be generalised". It is also worth noting that only specialist schools were investigated and we have no way of knowing how non-specialist schools compare.

Ofsted

C.9 In parallel with research commissioned by the government's education department, Ofsted has evaluated the specialist schools programme on two occasions (2001 and 2005). The earlier study focused on identifying the impact of the programme on: attainment and quality of provision in participating schools; how these schools were managing their role including with partner schools and the wider community; and examples of good practice and what factors contribute to it. As evidence Ofsted drew on examination data available for the 327 specialist schools operational by September 1998, school inspection reports, and visits by HMI to 46 schools of different specialist types. Ofsted (2001) concluded that four out of five schools were meeting the aims of the programme and making good use of the resources provided. Standards in terms of achievement of five or more GCSE A*-C and A*-G were shown to be higher in technology, languages and arts schools, but not in sports schools, than in maintained schools nationally. The trends in improvement in GCSE average points score in specialist schools and also the combined average point score in the specialist subjects were slightly above the national rate. Likewise, in each of the specialist subjects, specialist schools, excepting sports schools, outperformed other maintained schools nationally.

C.10 In 2005 Ofsted published a second evaluation of the programme based similarly on performance at GCSE (521 specialist schools by September 2000), inspection reports, and inspectors visits to 52 specialist schools. They declared their findings now showed that five out of six of the schools visited were achieving the aims of the programme. Compared to other schools they were also doing well on a range of indicators including leadership and management, quality of teaching and improving standards. The rate of improvement in pupils' performance in the specialist subjects was found, however, to be levelling off.

C.11 This favourable interpretation has been challenged. Glatter (2005) has argued that there is not sufficient evidence in the 2005 report to support its very positive summary. He points out that no consideration was given to other factors, such as the extra resources received by specialist schools, the number of selective schools in the cohort and the bar on schools in special measures applying to becoming specialist.

Specialist Schools and Academies Trust

C.12 The Specialist Schools and Academies Trust (SSAT) in its various guises has funded a raft of research into the specialist schools programme, but like the findings emanating from government departments it cannot be said to be entirely independent. We will be looking in detail at the work of Jesson and others on value added later, but that is not the only SSAT research. Rudd *et al* (2002) from the NFER, for example, carried out the first phase of a two-phase project funded by the Technology Colleges Trust, a forerunner of the SSAT. It was designed to investigate the *success factors* (our italics) underlying high performance in specialist schools, based on 20 case studies. Interviewees (headteachers, senior managers, governors, heads of department, classroom teachers, and student groups) were asked to identify the main success factors in their school. Key characteristics were found to be high quality teaching and learning; school ethos and culture; monitoring and evaluation; leadership and management; curriculum improvements; extra-curricular activities; and extra resources. The researchers went further and subsumed these key characteristics into nine success factors that made the difference to the schools' effectiveness: interconnectedness; whole-school ethos; management styles; teachers 'going the extra mile'; innovative use of staffing; focus on the individual student; active use of performance data; a broad and flexible curriculum; and resources and status.

C.13 In the second phase of the project (Judkins and Rudd, 2005) the schools were re-visited in 2004. Interviews were conducted as far as possible with the same participants as in 2002. In addition to the original nine success factors, three new ones were found. First, collaboration with the community, (parents, community groups, partner schools and international contacts) was thought to be hugely significant. Secondly, staff confidence had increased in relation to a spectrum of challenges and initiatives. The third factor was labelled 'creativity and innovation' - the need for vision, dynamism and inventiveness.

C.14 Castle and Evans (2006) have challenged the interpretation pointing out that only one of these factors, the provision of extra resources, can be directly attributed to specialist status. "All other factors could be present in effective schools no matter what their status."

Differentiation in the School System

C.15 Research sponsored by the government and SSAT has aimed to identify the benefits of specialist status. Independent research has tended to concentrate more on issues such as the increased differentiation in the school system entailed by the specialist schools policy, the effectiveness of specialist schools, and the role of extra funding. Gorard and Taylor, C. (2001) found that specialist schools tend to increase the socio-economic segregation of intakes. This is also true of schools that are selective or are their own admissions authority. There is a multiplier effect so that "when schools have two or more of these characteristics together, for example, foundation specialist or selective specialist, this tendency is far stronger". Fears that the creation of more specialist schools will lead to a two-tier education system have been reported (Thornton, 2001). Castle and Evans (2006) suggested that the policy could lead to the creation of a hierarchy of schools, but the evidence on the divisiveness of specialist schools, whether in relation to pupil intake or the extra resourcing received, is mixed.

C.16 From a different perspective, since specialist schools are expected to create a new identity or 'ethos', Solvason (2005) has explored the concept of 'ethos' as a facet of the specialist schools programme. She complains the concept is nebulous. In reality, it refers to the 'culture' of the school; in other words, "the basis on which the day-to-day life of the school is built over a considerable period of time and something that a school cannot readily conjure up". Furthermore, she contends there is the possibility that changing a school's culture or 'ethos' can have negative as well as positive effects.

Raising Performance

C.17 By far the most contested claim centres on whether specialist schools raise general educational performance. The argument in large part hinges on the data used and the methodology. The first studies (Taylor, C., 2000; Ofsted, 2001; and West *et al*, 2000) used raw examination data. Taylor based his evidence on the 1999 GCSE results to demonstrate that, in technology and performing arts schools, results in the subject specialism and associated subjects were greater than in all schools. The report by West *et al* (2000) used examination data for 1997 and 1998 and showed that the average points score for specialist subjects was higher, on average, in specialist schools of any type. The 2001 Ofsted report provided further evidence. Overall, in specialist subjects the combined average points score for each pupil was higher in technology, languages, arts, and sports schools than the average in other maintained schools. But Ofsted's second evaluation (2005), as we have already noted, reported that the rate of improvement in specialist subjects was levelling off.

C.18 The apparently improved performance in specialist subjects when raw examination data are used is also matched by improvements in general educational performance in specialist schools, defined in terms of five or more A*-C at GCSE, (West *et al* 2000, Yeomans *et al*, 2000, and Ofsted 2001). Whereas Ofsted found that the improvement in GCSE scores was slightly above the national average, Jesson (2003) reported that the difference was much greater; 54.1 per cent of pupils in specialist schools compared with 46.7 per cent in non-specialist schools gained five or more A*-C grades at GCSE.

Value Added

C.19 But it is widely accepted that comparing raw examination results without taking into account pupils' prior attainment or background can only be partial. Ideally, comparisons should be made by using 'value added', which takes account of these factors. The crux of the argument among researchers is about how this 'value added' should be calculated and depending on the method chosen the credence that can be given to the results obtained.

C.20 A major player in the field has been Jesson, inspired and funded by the SSAT, (Jesson, 2002a, 2002b and 2003; Jesson and Crossley, 2005, 2006, and 2007). He has claimed that "on a value added basis, specialist schools had a net value added of +4.5 compared with other schools". He then goes on to assert, "these excellent results strongly vindicate the Government's decision to expand the number of specialist schools to at least 2,000 by 2006". Jesson's conclusion can be disputed on two main grounds: first the scale of the difference in performance, because of the method he used to calculate value added; and, secondly, the error he makes of inferring that a difference in performance between two types of schools is causal.

C.21 Schagen and Goldstein (2002) have argued that Jesson's (2002a) method of calculating value added is flawed. He attempts to estimate the effect of specialist status on examination results by using regression methods on school level data. This method first predicts each school's exam results using a measure of prior attainment, such as the Key Stage 2 scores. This predicted value is then subtracted from the school's actual exam result to obtain an estimate of the school's performance. In his 2002 study, Jesson used the National Pupil Database, which contains the Key Stage 2 and GCSE outcomes for around half a million pupils. These data were aggregated to school level. Many of the variables, especially school context variables which affect examination results, were omitted. Only prior attainment and the percentage of boys in the school were included. Schagen and Goldstein argue that value added analysis should be conducted on pupil level data. Jesson aggregates the data to the school level. Schagen and Goldstein also maintained that a more sophisticated statistical procedure than regression analysis is necessary. Multi-level modelling should be used "since it is technically efficient and takes proper account of background factors and variations at school and pupil level". Furthermore, they emphasize that the statistical analysis should take account of all relevant contextual factors, particularly the percentage of pupils eligible for free school meals. This prerequisite is disregarded in the Jesson studies. According to Schagen and Goldstein, Jesson's analysis "fails on all three counts".

C.22 Schagen and Goldstein also dispute the logic of Jesson's approach. They suggest that while specialist status could have led to some improvement, the fact that one of the factors taken into account in awarding the status is a school's value added should not be ignored. They add that schools have to provide evidence of sponsorship, which they believe would be easier in middle class schools. It is possible to argue, therefore, that schools become specialist because they have a tendency to achieve better value added results. In his defence Jesson (2002b) complains that the academic world "is full of 'Jeremiads' (*sic*) ready to demolish anything in education that appears to go well (especially if it is a government initiative)". He suggests that virtually all evaluations of school performance use aggregated data.

C.23 Jesson's findings have also been challenged by other researchers. Castle and Evans (2006) query whether the percentage of five or more A*-C is an appropriate measure to use in the first place or should total GCSE points score have been used? Jesson (2003) uses total GCSE/GNVQ points score for the best eight subjects. He compares the difference between the predicted total points score and the actual total for pupils with different Key Stage 2 scores at specialist and non-specialist schools. His results show that specialist schools perform better. But it is difficult to assess the validity of these results because of the lack of statistical information given. Value added analysis of the 2002 GCSE results by Benton *et al* (2003) for the National Audit Office found that specialist schools added 0.84 of a grade at GCSE/GNVQ compared to non-specialist schools.

Multi-Level Modelling

C.24 Schagen *et al* (2002) and Schagen and Schagen (2003) have investigated specialist and faith schools using multi-level modelling. They found a small positive effect for specialist compared to non-specialist schools in the 2000 examination results, which varied from 1.5 GCSE grades to virtually no difference according to type of specialism.

C.25 In their report *Evaluating the Effectiveness of Specialist Schools*, Levacic and Jenkins (2004) presented a more extensive analysis based on students who took GCSE/GNVQs in 2001 and for whom, KS2 results in 1996 were available. They state at the outset that the government and the Specialist Schools Trust (now the SSAT), drawing on commissioned research, present specialist status as a causal factor in school improvement. They go on to demolish this claim:

> None of the research on specialist schools to date has used a research design that could test for causal impact of status. Instead studies have estimated the relative effectiveness of specialist compared to non-specialist in any given year, finding that specialist schools in general add about 1-2 grades at GCSE. This could be explained by more effective schools having been selected to become specialist, since poorly performing schools have not been able to become specialist.

C.26 In their analyses using data, which covered all English maintained secondary schools, Levacic and Jenkins used a three-level model (LEA, school and pupil). At pupil level, prior attainment, age and gender as well as school type, size, presence or absence of a sixth form and pupil composition (FSM, SEN and ethnicity) were all controlled for. They also introduced alternative measures of student attainment – total GCSE/GNVQ score, probability of a student obtaining five or more grades A*-C at GCSE/GNVQ and grades in individual specialist subjects. A school was classified as specialist if it had been specialist at the beginning of the academic year in 2000-01.

C.27 Their results show that on average specialist schools are estimated to have added 1.4 grades to a student's GCSE/GNVQ total score compared to non-specialist schools. The difference becomes smaller when the sample is limited to schools with the highest probability of becoming specialist (because like is closer to being compared with like). There are also differences according to gender. Boys appeared to benefit most. A boy was found, on average, to be 2.9 per cent more likely to get five good GCSEs at a specialist school compared to a girl's 1.6 per cent. These estimates are lower than those from the SSAT but within the range found in other studies. The researchers make it clear that the different size effects reported for different types of specialist school describe "differential effectiveness and should not be given a causal interpretation".

Years Specialist

C.28 There are also differences in performance according to the length of time the schools have been specialist. Levacic and Jenkins suggest that these differences could be because the more effective schools may have been selected to become specialist in the first place, or that "raising standards after becoming specialist may take several years to materialise". The length of time a school has been specialist is also disaggregated according to type of specialism. Technology schools of 5-7 years standing were more effective than languages schools of the same duration; and languages and performing arts schools of 1-4 years standing more effective in overall GCSE performance than non-specialist schools. Unlike other studies, the results do not show the poorer performance of sports schools relative to other specialisms reported in other studies. All specialist schools added value in their specialist subject, apart from IT. The estimated value in the specialist subject is modest – around 0.14 grades - excepting in PE. Only technology and sports schools added value to specialist subjects, other than their own, which is consistent with their better overall GCSE performance.

C.29 More detailed analysis, including interaction effects between specialist status and other factors, provided evidence of the relative effectiveness of specialist schools for different kinds of pupils analysed by gender, ability and eligibility for free school meals. On the basis of their evidence and of that from other studies Levacic and Jenkins conclude that:

> Some specialist schools, in particular those of long standing and the more recent Technology and Sports schools, are more effective than non-specialists. The most favourable of our findings is the additional added value of specialists with high proportions of pupils eligible for free school meals. Taken overall the effects of specialist schools are modest in size, not uniform across specialisms and dependent on the assumption of no selection bias in specialist schools recruitment that is not controlled for by the observed pupil data.

C.30 Research by Noden and Schagen (2006) used multiple linear regression and multi-levelling modelling to examine pupil's attainment. Their results show that in 2001, pupils in specialist schools achieved better examination results than pupils at non-specialist schools. As in Levacic and Jenkin's study, their findings indicate that pupils attending the earlier cohorts of specialist schools performed particularly well. In addition, they suggest that some cohorts of specialist schools were achieving enhanced value added before they became specialist. Analysis of GCSE results in specialist and non-specialist subject areas indicated that languages and sports schools achieved better than expected results in their specialist areas, technology schools achieved better results in both specialist and non-specialist areas but not so the arts schools. These findings are very much in line with the results obtained in the detailed work by Levacic and Jenkins (2004)

C.31 Taylor, J. (2007) maintains the government and its agencies have seriously overestimated the impact of the specialist schools programme on educational attainment. He attributes the substantially higher exam scores achieved on average by schools with specialist status primarily to sample selection bias. Levacic and Jenkins have pointed out this same shortcoming in the analyses they and other researchers have carried out. Taylor applies a different statistical model (a fixed effect model using panel data of all maintained secondary schools in England from 1992-2005) to remedy the bias in the data. This he claims enables a more stringent comparison of GCSE examination performance. Schools acquiring specialist status are the 'treated group' and non-specialist schools the 'control group'. The aim of his analysis was "to estimate the extent to which a school's change in status is associated with a change in its exam outcome for the treated group compared with the non-treated group".

C.32 A significant specialist school effect could only be detected for four of the ten subject specialisms. The largest was for business & enterprise (2.9%) followed by technology (1.9%). Schools specialising in the performing arts and science are the only other types with significant effects (at around 1.0%). On average over all specialist schools, the acquisition of specialist status is associated with a one percentage point increase in the percentage of pupils obtaining five or more A*-C at GCSE. Contrary to other research findings his results also show a fall in the estimated effect over time. Taylor's analysis also confirms that the specialist schools programme is more effective for some groups of pupils than others, what he describes as 'distributional consequences'. There is evidence that schools with the highest proportion of pupils eligible for free school meals (FSM) have experienced by far the biggest improvements in examination results as a consequence of specialist status. Yet, in practice, schools with the least likelihood of improvement (those with the lowest proportion of pupils eligible for FSMs) are more likely to become specialist.

Extra Funding

C.33 Questions about the funding of specialist schools have been raised, by the House of Commons Education and Skills Committee (2003) and in parliament (Hansard, 2002). Taylor, J. (2007) has pointed out that it is not possible to deduce whether specialist status of itself is producing improvements because it is accompanied by extra money:

> The crucial question still to be answered is whether specialist schools do well because of the extra funding they receive or as a result of some other factor, such as an improvement in the quality of teaching or a better match between the interests of the pupils and the courses on offer.

C.34 A recent paper by Mangan, Pugh and Gray (2007), attempts to throw some light on this issue. The aim was to analyse jointly the performance effects of increased expenditure and specialist status. To date there is no consistent research evidence on the relationship between school resources and school outcome. Vignoles *et al* (2000) in their evaluation of the literature on school efficiency identify poor statistical techniques and poor quality data as major barriers to progress. Mangan *et al* applied a statistical model using panel data rather than static cross-sectional analysis, which reduces the problem of sample bias in the data. The panel data, which covered a five-year period from 1999/00 to 2003/04, comprised examination data from the Performance Tables (percentage of pupils who obtained five or more A*-C at GCSE) and annual expenditure data on school outturn submitted to the government by the LEAs.

C.35 Their findings show that increase in funding is associated with a modest increase in school performance. They calculated that an increase of about one-fifth in the average spending per pupil would raise the proportion of pupils obtaining five good GCSEs by 1.5%. Overall they found the effect of expenditure on specialist schools was not significantly different from the effects on schools as a whole. In other words additional funding for specialist schools achieves about the same return in terms of examination performance as additional funding for maintained secondary schools in general. The only specialist subject area with a significant performance differential, was sport, where there was an estimated reduction of 0.5%. Taken together the results show a small positive effect of additional spending but this effect does not depend on acquiring specialist status. The question of whether increased resourcing in schools leads to improved student outcomes is proving difficult to answer (Levacic *et al,* 2005). But it is worth noting that the head of Ofsted, Christine Gilbert, at the Specialist Schools and Academies Trust, Annual Conference 2007 (BBC News On-line, 2007), was explicit that the extra resources given to specialist schools were no guarantee of higher standards.

Impact of the Policy

C.36 Castle and Evans (2006) have also reviewed the evidence on specialist schools. They organised their critique around two main themes: impacts on equity and accessibility; and on teaching and learning including methods for estimating value added by schools. They concluded that “the evidence about specialist schools is equivocal about their impact”. Research analyses and evaluations show “the majority of specialist schools are highly effective”. But they point out, “whether this is due to their selection practices (overt and covert), or to being already highly effective in order to obtain specialist status is not clear”. In summary, they say “ there is no proven link between the improved performance of these schools and their specialist status”.

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