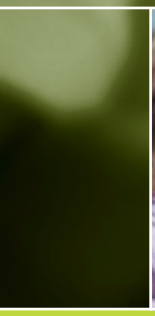
Primary Schools - ICT and Standards

An analysis of national data from Ofsted and QCA by Becta



Becta

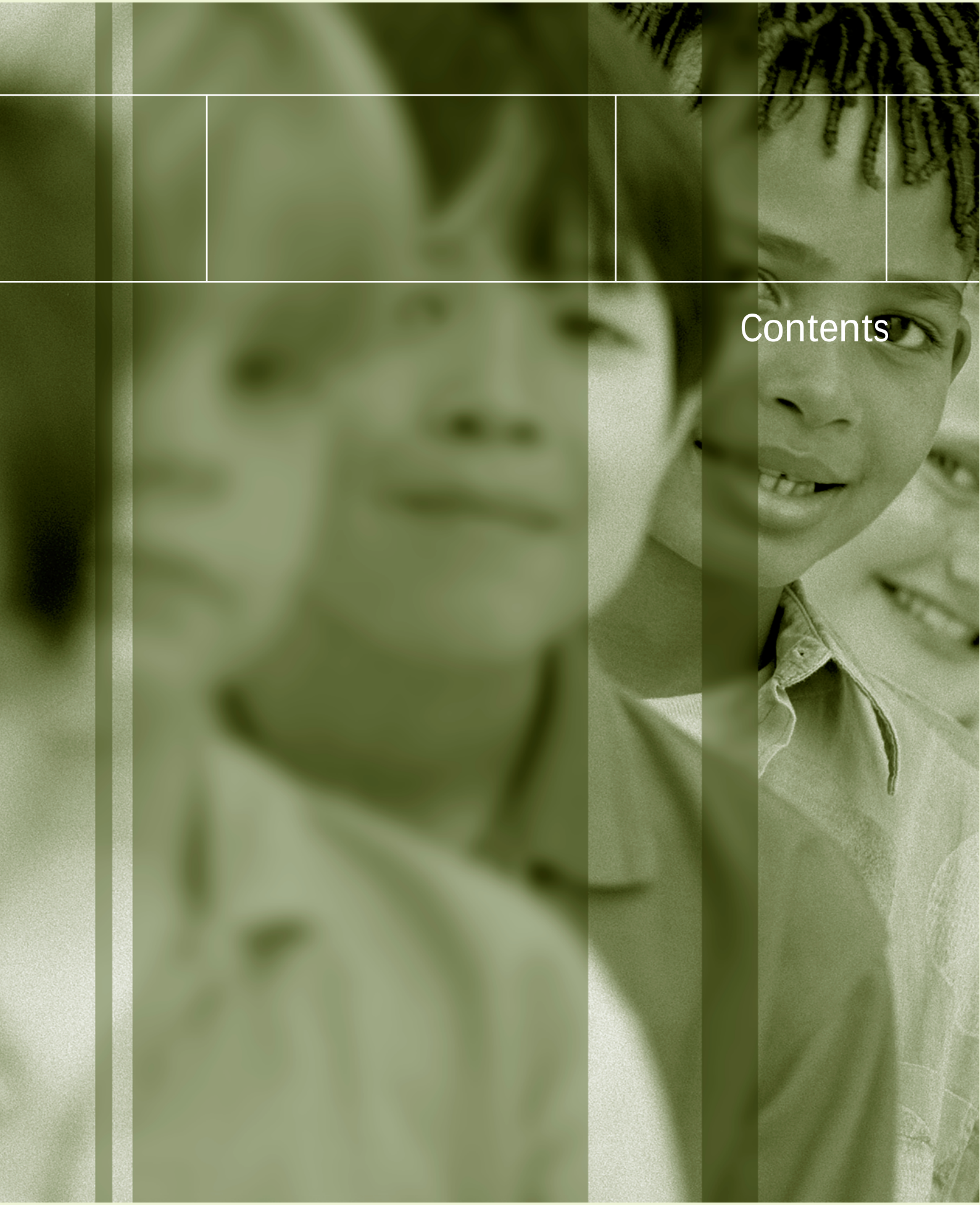
ICT Research

Foreword

Over the past few years Becta has established a growing body of evidence on the impact of ICT on standards in our schools. This report, based on a detailed analysis of the results of Ofsted inspections and QCA data on schools' performance in national tests, adds further weight to the case for ICT's continuing positive impact. An additional significance of this report is that it starts to identify enablers which lead to the most effective use of ICT in the teaching and learning process.

The evidence from this study suggests that the degree to which schools are addressing these, and other factors highlighted in the report, will have a critical impact on their ability to provide quality ICT teaching and learning opportunities which in turn will lead to improved standards. This is a significant report. I encourage you to read it and consider the implications for your school.

Owen Lynch, *Chief Executive, Becta*



Contents

Introduction

This report is part of a series of publications aimed at exploring the relationship between schools' use of ICT and pupils' achievement in national tests and examinations. It builds on earlier publications and complements reports published in the DfES/Becta research and evaluation series. It examines the relationship between the use of ICT and educational standards based on data obtained on schools from Ofsted inspections for the academic year 2000–01. This is further supplemented by test and examinations data from QCA for the same period.

The analysis is similar to that described in the Becta report ***Primary Schools – ICT and Standards***, published in January 2002, which reported on schools inspected in the period January to July 2000. The main conclusions of that report were:

- Schools with good ICT resources tended to have better achievements than schools with unsatisfactory ICT.
- When schools in similar socio-economic circumstances were compared, schools with good ICT resources still tended to have better achievements than schools with unsatisfactory ICT.
- When schools with similar quality of leadership were compared, those with good ICT resources still tended to have better achievements than schools with unsatisfactory ICT.
- Schools that made good use of ICT within a subject tended to get better results in that subject than other schools.
- Schools that had good ICT resources combined with good use of ICT tended to achieve better results at Key Stage 2 than those schools where ICT resources were not used well.

This report considers the question 'Are these conclusions substantiated by the new data analysis?'

Like the previous report, this analysis considers data at the 'whole school' level. Judgements about teaching and learning made by Ofsted are about the school as a whole, not individual teachers and learners. The analysis looks only at the statistical relationships between different factors within the data obtained from Ofsted inspections and QCA test and examination results. Where there is subjective interpretation, this is indicated in the text as such. The ImpaCT2 series of publications provide an insight into how ICT impacts on the achievement of individual pupils. These reports are all available on the research area of the Becta web site [http://www.becta.org.uk/research/].

Brief descriptions of statistical methods, the size and the characteristics of the sample used in this report are included in the Appendices.

Executive summary

Section 1 – The relationship between ICT and standards

The relationships between ICT and educational standards are investigated for schools inspected in the academic year 2000–01. Where relevant, comparisons are made with data from the datasets covering September 1998 to July 1999, and January to July 2000 in order to verify the findings published in earlier reports.

The differences in pupils' achievements between schools with high and low ICT discovered in earlier analyses are also found in the analysis of the results for 2001.

As with earlier years' analyses, high ICT schools outperformed low ICT schools in the same socio-economic group. This indicates that the relationship between ICT resources and standards is not simply a result of more privileged schools acquiring better ICT resources. It also suggests that good socio-economic circumstances are not a pre-requisite for effective use of ICT.

When schools with a similar quality of leadership are compared, those with good ICT resources tend to achieve better results than those with unsatisfactory ICT resources, whatever the quality of leadership. This differs from the analysis in 2000, which found a negative relationship between ICT resources and standards in schools where leadership was unsatisfactory.

Schools where ICT is used well within a subject tend to achieve better results in that subject than other schools. Likewise, schools that combine good ICT resources with very good ICT teaching gain better results than those with good ICT resources but poor ICT teaching. These results show that the presence of ICT resources alone is less important than the combination of good resources and effective use.

The findings from analyses carried out in previous years have been verified by analysis of a new sample of 2,582 schools receiving a full inspection in the academic year 2000–01.

Section 2 – ICT and subjects

The presence of ICT learning opportunities is strongly related to good use of ICT in English, mathematics and science. This supports the view that in primary schools where the same teacher in the same classroom generally teaches ICT, English, mathematics and science, ICT capability is closely related to ICT use in subjects.

Where ICT is used well within the subject this is generally an indicator of good subject teaching, although there are obviously many schools where subject teaching is judged to be good, but ICT is not used. Good subject teaching seems to be essential for good use of ICT in that subject. Although the reverse is not essential, it makes it more likely.

There is a strong relationship between the use of ICT and subject results. 61% of schools in the sample with good use of ICT in mathematics are at or above national standards in mathematics, against 38% of schools with unsatisfactory use of ICT. The equivalent figures for English are 62% and 36%, and for science are 68% and 37%.

The use of ICT in any curriculum subject is associated with improvements in all core subjects. The more subjects ICT is used for, the better the results across all subjects.

Section 3 – A developing model

Previous statistical analysis outlined an exploratory model linking schools' ICT resources and educational standards. Using new Ofsted judgements, in particular the grade given for 'ICT learning opportunities', the analysis suggested that ICT resources best supported improvements in standards where they were used effectively in the classroom to support learning.

This report looks again at this exploratory model, and presents further analysis to demonstrate improved learning. As with previous reports, the analysis is based on statistical association and cannot prove causality, but it does give further credibility to the conclusion that the impact of ICT is crucially dependent on how it is used in the classroom.

Section 4 – Schools' readiness for ICT

Five factors are identified that are present in the development of good ICT learning opportunities in schools. These 'ICT enablers' are identified from a list of seven school and ICT factors that have the highest association with learning standards overall and together represent a context for the learning process. The five crucial factors are:

- **ICT resourcing**
- **ICT leadership**
- **ICT teaching**
- **school leadership**
- **general teaching.**

Two other variables – the socio-economic grades applied to the school and the prior attainment of pupils - are not found to be crucial.

The analysis shows that each of these five ICT enablers is necessary, but each is not sufficient by itself to provide good ICT learning opportunities. The presence of all five factors increases the possibility of good ICT learning opportunities. Last year's analysis pointed towards a threshold effect, with little gain being found until four enablers were in place. In contrast with that analysis, there now appears to be a linear relationship between the number of ICT enablers and providing good ICT learning opportunities. The number of schools with four or five ICT enablers in place increased in 2000–01. Pupils' access to good ICT learning opportunities is dependent on the overall quality of a school's general teaching and general leadership.

The presence of good or very good ICT resources makes good learning opportunities more likely. Last year only 3% of primary schools that had unsatisfactory ICT resources provided good learning opportunities in ICT, this figure has risen to 23% in 2001. This suggests that some schools are working to provide good ICT learning opportunities for their pupils, despite low levels of ICT resourcing.

Schools with good or very good leadership are nearly twice as likely to have good ICT resources than those with poor or unsatisfactory leadership, and those with good leadership are almost three times as likely to provide good ICT learning opportunities than those with satisfactory leadership. Schools with good leadership and good ICT have better results than schools with good leadership and poor ICT.

Schools with good or better general teaching provide far more ICT learning opportunities than those schools where general teaching is satisfactory or worse. Schools judged by Ofsted to have good general teaching have teachers with a good understanding of ICT, but those judged to be satisfactory or worse do not. Schools with good teaching and good ICT resources generally achieve better results than schools with good teaching and unsatisfactory ICT.

This suggests that most of the improvements in standards related to ICT resources are found in schools with good leadership and good teaching, although ICT leadership and ICT teaching also follow these trends.

Analysis of the schools and the five ICT enablers shows that 17% of primary schools have all five in place. Schools with a high number of ICT enablers usually have good general leadership and good general teaching. Schools with good ICT teaching usually have good ICT leadership and schools with good ICT resources usually have all other factors in place. This confirms the findings from 2000, and supports the conclusion that ICT implementation follows a relatively logical progression. There continues to be concern, however, for those schools that do not have the base levels of good leadership and teaching on which to build.

Section 5 – Socio-economic factors

Following trends identified in the previous report, there is no notable difference in ICT resources between schools in different socio-economic circumstances. In fact, in comparison to last year, less advantaged schools now appear to have slightly better resources than those more privileged, perhaps demonstrating the success of recent initiatives to bridge the 'digital divide'.

While schools in higher social grades continue to offer slightly better ICT learning opportunities than others, analysis for 2001 shows a marked improvement in ICT learning opportunities for all socio-economic circumstances, with opportunities more than doubling in those schools in low social grades.

Pupils' ICT attainment is generally independent of socio-economic circumstances, and likewise ICT attainment is generally independent of pupils' prior attainment.

Generally, there is a positive relationship between good ICT attainment and improved standards in English, mathematics, and science, with those schools in less favourable circumstances showing a slightly more pronounced trend.

Section 6 – Other positive outcomes

Pupils in schools with very good ICT resources are generally judged to have better attitudes and behaviour than those with poor or unsatisfactory ICT resources. The relationship is stronger if ICT learning opportunities are also considered.

In schools with good ICT resources, the attitude of parents towards the school is generally judged to be better than those in schools with poor or unsatisfactory ICT resources. This relationship is again stronger if ICT learning opportunities are also considered.

While these findings suggest an association between good use of ICT in schools and the motivation of pupils and parents, they should be treated cautiously, as many other factors such as good leadership and good teaching can have an impact. Further research is needed to demonstrate that good ICT can help to develop good school ethos and home links, and vice versa.

There is a strong relationship between pupils' attainment, effort and independence in ICT and the quality of ICT resources, their strategic use and teachers' understanding of ICT. However, whereas achievement and effort improves year on year, the same trend is not seen for pupils' interest. This suggests that there is more work to be done in engaging those pupils who currently feel disenfranchised from ICT use. This work can further help to bridge the digital divide.

Section 7 – The variation between schools

The variation seen between schools in relation to ICT variables is large, and greater than for many general school factors. ICT resources continue to vary between schools, with more schools having good or very good resources than in previous years.

There is considerable variation in key stage attainment between individual schools in each band, and although this is least when ICT learning opportunities are very good, this is less noticeable than last year. This suggests that the combination of ICT resources, their strategic use, and ICT learning opportunities are equally important.

Grades for ICT leadership vary more than general school leadership, with fewer schools achieving high grades for ICT leadership. However there is a distinct improvement upon the previous report, with more schools scoring good or very good, and fewer schools scoring unsatisfactory or worse for their ICT leadership. A similar trend is shown when ICT teaching is compared to general teaching.

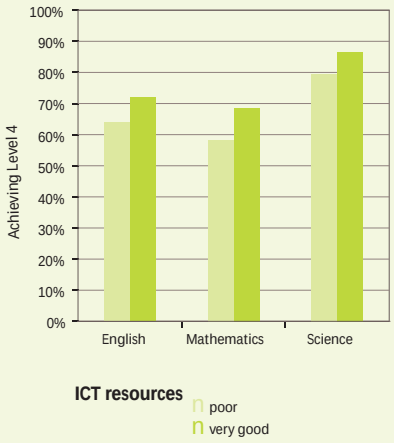
The differences between schools are large, which may reflect the variation in the quality of use of ICT as well as other factors. Although there are undoubtedly improvements in 2001, there is a continued need to improve the quality of ICT leadership, ICT teaching and ICT use in the classroom in order to reduce further these differences.

Section 1 – The relationship between ICT and standards

The relationship between ICT and standards

In the previous report dealing with data collected January to July 2000, schools that were judged by Ofsted to have very good ICT resources were found to have better achievements than schools with poor ICT. This report re-examines the factors considered in earlier reports to determine continuing trends in 2001[1].

Fig 1.1 ICT and Standards



ICT and standards

English, mathematics and science results at Key Stage 2 in schools with very good ICT resources are compared with those which are considered to be poorly resourced.

Figure 1.1 shows results for 2,582 primary schools that received a full inspection during the academic year 2000–01. The quality of ICT resources was determined from judgements made through Ofsted inspections[2] and the Key Stage 2 results for each school were obtained from national data collected by QCA. The height of the bar gives the average percentage of pupils reaching Level 4 in the attainment targets in English, mathematics and science in the Key Stage 2[3] tests in these schools.

As with the findings in the previous report, there is a continuing trend for those schools with very good ICT resources to outperform those with poor resources.

Table 1.1 gives the precise percentages and compares results for schools inspected in the period ending July 2001 with results of the schools inspected in the period ending July 2000.

Table 1.1 Average percentages of pupils achieving Level 4 in core subjects in the periods ending July 2001.

	Poor ICT	Very good ICT resources	Difference
English	64% (66%)	72% (75%)	+8% (+9%)
Mathematics	59% (63%)	69% (72%)	+10% (+9%)
Science	80% (74%)	87% (86%)	+7% (+12%)

Figures for the period ending July 2000 are shown in brackets.

Results in English and mathematics have seen a slight drop, year on year, in both those schools in the sample with very good ICT resources and those with poor ICT resources. Science, however, does not show the same trend with increases for both. This follows the national trend. Although the overall differences across all subjects are slightly less than for last year, differences between achievements in schools with very good ICT resources against those with poor resources remain.

1 Previous reports in the series and a fuller description of the statistical techniques used, are available on the Becta web site [http://www.becta.org.uk/research/].

2 A brief description of Ofsted inspection judgements is given in Appendix 1.

3 The measure taken for standards was that normally used for national statistics – the percentage of pupils reaching Level 4 at Key Stage 2 in English, mathematics and science.

The relationship between ICT and standards

Fig 1.2a KS2 English, Over Three Years

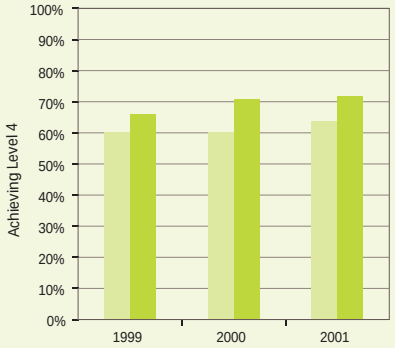


Fig 1.2b KS2 Mathematics, Over Three Years

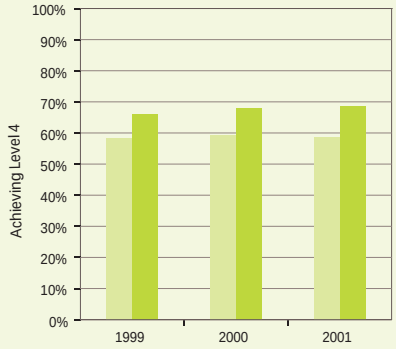
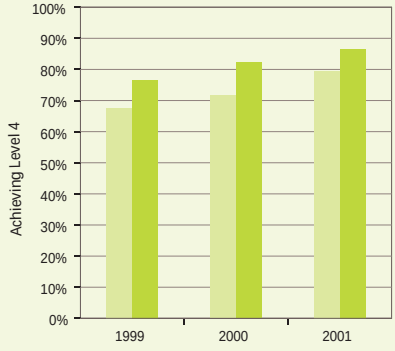


Fig 1.2c KS2 Science, Over Three Years



The relationship between ICT and standards over three years

The three graphs in **Figure 1.2** show the average Key Stage 2 results, by subject, for schools inspected in the period ending July 2001, further divided by schools with very good ICT resources and those with poor ICT resources. These are compared with results from the datasets covering 1999 and 2000 to show trends over a three-year period.

If comparing figures over three years, a continuing trend is apparent. The differences between those schools with very good ICT resources and those that are poorly resourced have remained consistent over the three years.

ImpaCT2

ImpaCT2 (a large-scale longitudinal study tracking over 2000 pupils' use of ICT for three years) discovered a positive association between individual pupils' use of ICT and their performance in the Key Stage 2 national tests in English and mathematics. The positive effect in English was statistically significant and equivalent to 0.16 of a National Curriculum level. The difference in test performance between high ICT and low ICT using pupils in mathematics was equivalent to 0.061 of a level, although this failed to reach statistical significance. A small negative association in science (equivalent to 0.009 of a level) was discovered which was far from statistical significance.

Comparing ImpaCT2's findings (which are at the individual pupil level) with those set out above suggests that the effective use of ICT is more complex than simply translating increased resourcing at the school level into increased access for individual pupils. Later sections of this report draw out the importance of effective teaching and management and their role in translating increased resourcing into higher standards.

Good and very good ICT resources

So far, this report has made comparisons between the two extremes of provision – the schools with 'very good' (Ofsted grade A) and 'poor' (Ofsted grade E) ICT resources. The difference in resources between these two groups is marked, and the difference in key stage results is considerable.

These are important groupings for consideration in this report. The expectation is that more schools will reach the category of 'very good' ICT resources in coming years, and that fewer schools will by then have 'poor' ICT resources.

Table 1.2a shows the sample size used in this report compared with that used in the period ending July 2000. While the overall sample size has increased this year, the table shows a positive trend with more schools receiving good or better grades for ICT resources, and fewer schools being rated as satisfactory or worse. As sample sizes for A* and E* were very small, these have been combined with grades A and E respectively.

Table 1.2a Ofsted classifications of ICT resources in sample

	Size of sub-sample 2000	2000 %	Size of sub-sample 2001	2001 %	Difference %
Very good (A & A*)	106	8%	268	10%	2%
Good (B)	316	25%	760	30%	5%
Satisfactory (C)	506	40%	1007	39%	-1%
Unsatisfactory (D)	270	22%	486	19%	-3%
Poor (E & E*)	54	4%	50	2%	-2%
Total	**1252**	**99%**	**2571**	**100%**	**-**

The samples for grade A and particularly grade E in 2001, like 2000, are still relatively small . This makes it difficult to carry out further statistical analysis (for example, further dividing the sample by social grade or management quality) without reducing the statistical confidence of the results.

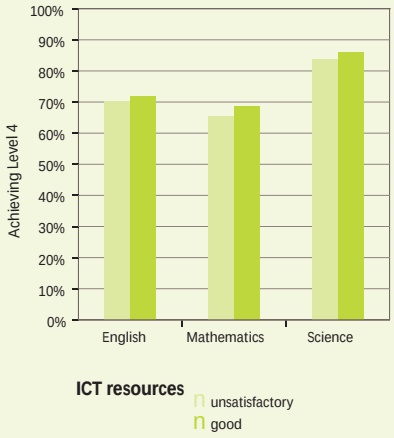
It is possible to expand the sub-sample size by combining schools in adjacent categories at the higher and lower ends of the scale. **Table 1.2b** shows the increased sample size that can be obtained in this way. As would be expected, the differences of performance for these two samples are less marked than when only the extreme categories are compared.

Table 1.2b Increasing the sub sample size for the period ending July 2001

	Size of sub-sample 2001
Good or very good (grades A*, A and B)	1028
Unsatisfactory or poor (grades D, E and E*)	536

Figure 1.3 demonstrates that there is still a noticeable difference between the two more broadly defined groups. In this figure, 'good' means good or very good, and 'unsatisfactory' means unsatisfactory or poor.

Fig 1.3 Good ICT and Standards



The relationship between ICT and standards

Fig 1.4a KS2 English, ICT and Social Grade

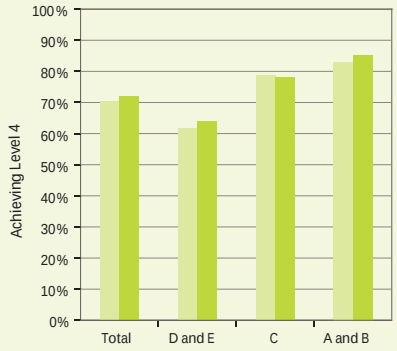


Fig 1.4b KS2 Mathematics, ICT and Social Grade

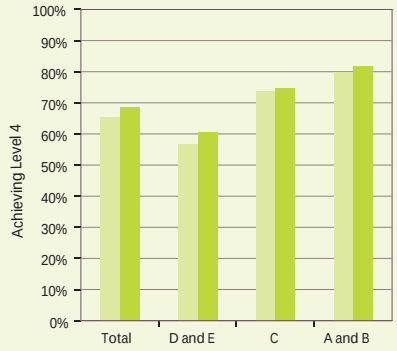
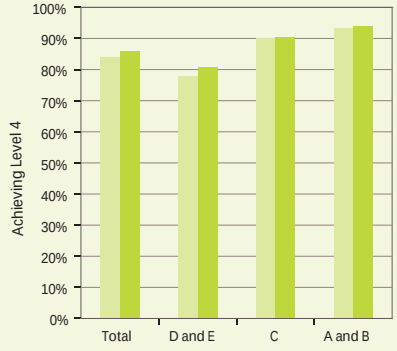


Fig 1.4c KS2 Science, ICT and Social Grade



ICT resources

n unsatisfactory
n good

Is the socio-economic grade of the school a factor?

Last year's report examined a number of factors that could provide an explanation for the difference in performance of schools with very good and poor ICT resources. One simple explanation for this difference in standards would be if schools in better socio-economic circumstances tended to have better ICT resources. This secondary relationship was investigated by examining whether there is a link between ICT resources and standards among schools in the same socio-economic grade (SEG).

The sequence of graphs in Figure 1.4 repeats this analysis for schools inspected in the period ending July 2001.

Differences are apparent between the various socio-economic grades. However, when schools with good ICT resources and unsatisfactory ICT resources[4] within the same socio-economic grade are compared, those with good resources still achieve better results. This reinforces the findings from the previous report.

The issue of socio-economic differences is explored further in Section Five.

4 The rationale for using the wider bandings for ICT resources is provided in Table 1.2a and Table 1.2b.

Is the quality of leadership a factor?

Figure 1.5 shows Key Stage 2 results among sub-samples defined by the quality of leadership.

The graphs firstly show that schools with better leadership, as judged by Ofsted, tend to get better results in Key Stage 2 tests.

Secondly, analysis for the period ending July 2001 shows that better ICT resources are associated with better results, irrespective of the quality of school leadership, whereas the previous year's findings showed a different relationship. In 2000, in schools where leadership was 'very good', 'good' or satisfactory', better ICT resources were associated with better results, but where schools had poor leadership, there was no such association, and in fact the relationship appeared to be a negative one.

This may indicate that as ICT in schools becomes more established, the negative impact of poor leadership (a factor which can adversely affect the early phase of development) is overtaken by the general level of confidence in the school. Clearly, any conclusions of this type must be extremely tentative at this stage and the general message about the combined importance of good leadership and effective ICT implementation remains.

Leadership issues are investigated further in Section Four.

Fig 1.5a KS2 English Results and School Leadership

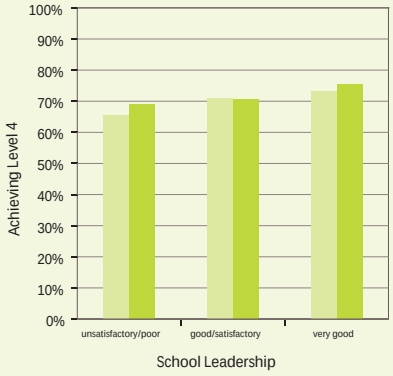


Fig 1.5b KS2 Mathematics Results and School Leadership

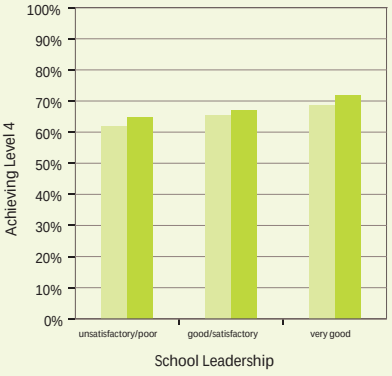
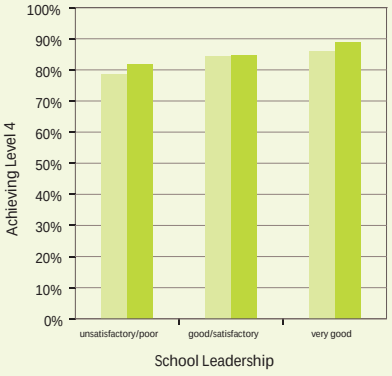


Fig 1.5c KS2 Science Results and School Leadership



ICT resources

- unsatisfactory
- good

The relationship between ICT and standards

Fig 1.6 Subject Use and KS2 Results

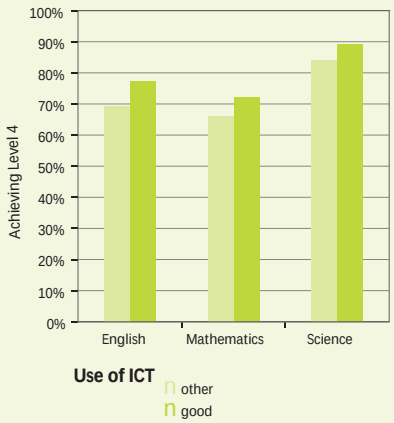


Fig 1.7 ICT Teaching in Schools with Good ICT Resources

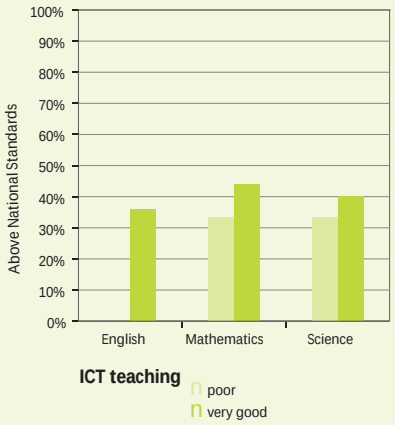
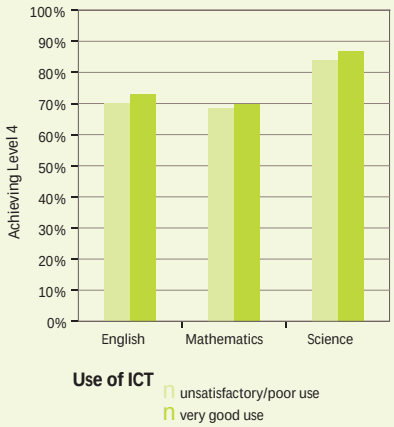


Fig 1.8 Use of ICT in Schools with Good ICT Resources



Is subject use a factor?

Ofsted inspections include judgements on the quality of use of new technologies in each subject.

Figure 1.6 shows the average results for those schools that are judged to make good use of ICT in a subject compared to those who do not.

Schools that make good use of ICT within a subject tend to get better results in that subject than those which do not.

ICT and subject use is further investigated in Section Two.

ICT, standards and ICT teaching

The analysis for the period ending July 2000 showed that schools with good ICT resources and very good ICT teaching did considerably better than schools with good ICT resources but poor ICT teaching. **Figure 1.7** demonstrates a continuing trend in the period ending July 2001. In these graphs, the height of the bars shows the percentage of the sample getting above the national expectation for that subject, as measured by the percentage of pupils reaching Level 4 in that subject. In the sample, there were no schools with good ICT resources that had poor ICT teaching in English.

ICT, standards and the use of ICT

Ofsted makes judgements on the use of ICT in schools. **Figure 1.8** shows Key Stage 2 results for schools with good ICT resources. Average numbers achieving Level 4 are compared between schools judged to make 'very good use of new technology' to support the ICT curriculum, and those judged to make unsatisfactory or poor use.

Following the trend from the previous period ending July 2000, schools with good ICT resources that use them well achieve slightly better results than those schools with similar resources used less effectively.

Conclusions

This section investigated the relationships between ICT and educational standards for schools inspected in the academic year 2000–01. Where relevant, comparisons have been made with data from the datasets covering September 1998 to July 1999, and January to July 2000 in order to verify the findings published in earlier reports.

The differences in pupils' achievements between schools with high and low ICT discovered in earlier analyses were also found in the analysis of the results for 2001.

As with earlier years' analyses, high ICT schools outperformed low ICT schools in the same socio-economic group. This indicates that the relationship between ICT resources and standards is not simply a result of more privileged schools acquiring better ICT resources. It also suggests that good socio-economic circumstances are not a pre-requisite for effective use of ICT.

When schools with a similar quality of leadership were compared, those with good ICT resources tended to achieve better results than those with unsatisfactory ICT resources, whatever the quality of leadership. This differs from findings in the previous report, which found a negative relationship between ICT resources and standards in schools where leadership was unsatisfactory.

Schools where ICT was used well within a subject tended to achieve better results in that subject than other schools. Likewise, schools that combined good ICT resources with very good ICT teaching gained better results than those that had good ICT resources but poor ICT teaching. These results show that the presence of ICT resources alone is less important than the combination of good resources and effective use.

The findings from analyses carried out in previous years have been verified by analysis of a new sample of 2,582 schools receiving a full inspection in the academic year 2000–01. There is, therefore, evidence that the results in previous years' reports were not due to chance.

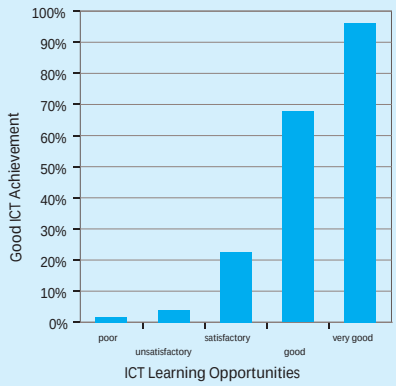
Section 2 – ICT and subjects

ICT and subjects

Ofsted's inspection framework requires judgements on two aspects of ICT. Firstly, on those ICT factors relating to ICT as a subject - ICT teaching, ICT learning opportunities and ICT achievement, and secondly, on the quality and use of new technologies within a subject. This section looks further at the relationship between ICT, subject use and subject attainment. In particular, it explores the relationship between good ICT learning opportunities and standards achieved in ICT and the core subjects. It addresses the key question:

'To what extent does the explicit teaching of ICT (through the provision of good ICT learning opportunities) relate to improved standards across the curriculum?'

Fig 2.1 ICT Learning Opportunities and ICT Achievement

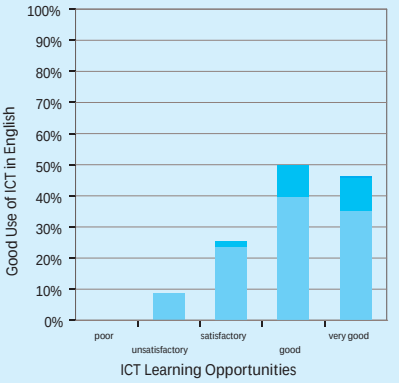


ICT learning opportunities and subjects

Figure 2.1 shows that pupils' achievements in ICT as a subject are strongly related to ICT learning opportunities. This is a predictable finding as pupils are unable to develop or show their ICT capability without good ICT learning opportunities.

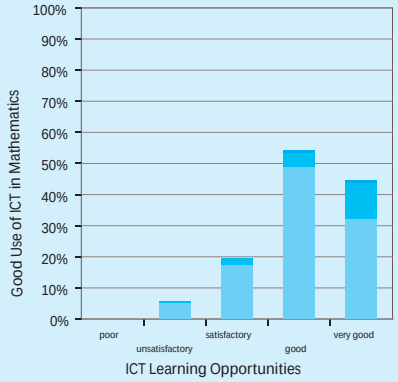
ICT and subjects

Fig 2.2a ICT Learning Opportunities and ICT in English



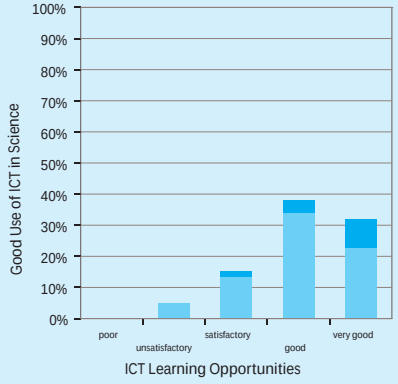
Use of ICT in English n excellent n good n very good

Fig 2.2b ICT Learning Opportunities and ICT in Mathematics



Use of ICT in mathematics n excellent n good n very good

Fig 2.2c ICT Learning Opportunities and ICT in Science



Use of ICT in science n very good n good

Figure 2.2 shows the relationship between ICT learning opportunities and ICT use in a subject. In English, mathematics and science, good use of ICT is strongly related to ICT learning opportunities and vice versa. The trend shows a greater incidence of good or very good achievements as ICT learning opportunities increase. This supports the view that in most primary schools where the same teacher generally teaches ICT, English, mathematics, and science, ICT capability is closely connected to the use of ICT in subjects. For example, schools that provide good ICT learning opportunities also tend to provide opportunities for pupils to apply and develop what they have learnt about ICT in good uses of ICT in other subjects.

Pupils' ICT achievement and ICT use in subjects

Given the close relationship between the provision of good ICT learning opportunities and good uses of ICT in other subjects, it is important to establish whether teachers' use of ICT in other subjects is related to pupils' developing ICT achievement. **Figure 2.3** shows a similar relationship between pupils' ICT achievement and ICT use in subjects, illustrating that these are also linked. This suggests that for most primary schools ICT usage provides support for subject teaching and improved ICT skills.

Fig 2.3a ICT Achievement and ICT in English

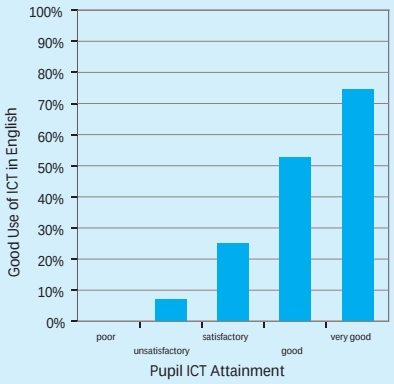


Fig 2.3b ICT Achievement and ICT in Mathematics

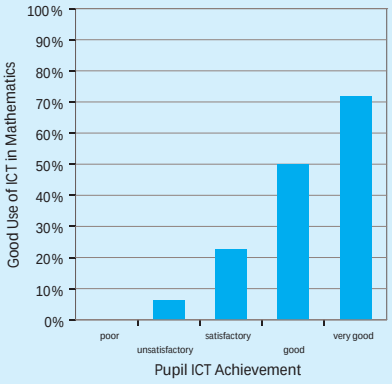
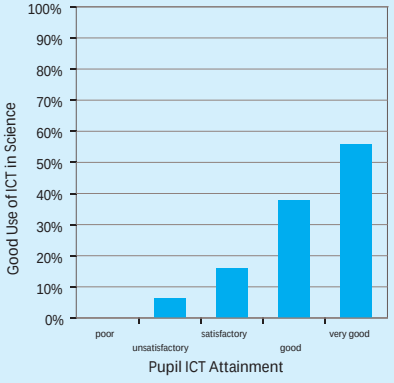


Fig 2.3c ICT Achievement and ICT in Science



ICT and subjects

Fig 2.4 Mathematics Teaching and ICT in Mathematics

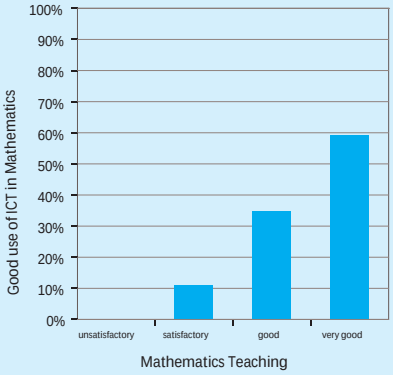


Fig 2.5 ICTin Mathematics and Mathematics Teaching

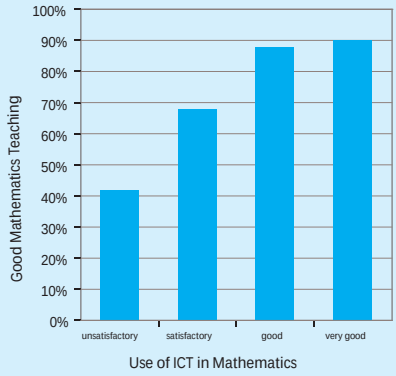
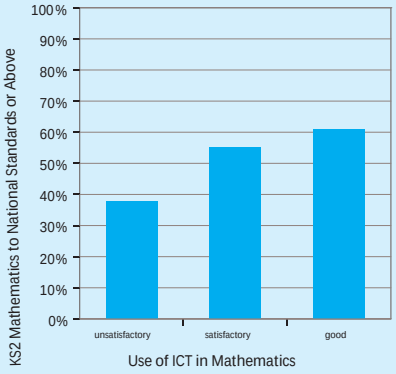


Fig 2.6 Use of ICT in Mathematics and Mathematics Achieving National Standards



ICT and teaching in the subject

Figure 2.4 shows that good use of ICT in mathematics is related to the quality of mathematics teaching. As will be shown in Section Four, there is a strong link between general teaching and ICT learning opportunities and this is reflected in subject teaching as well.

Figure 2.5 shows that the reverse relationship holds but is less pronounced. Where ICT is used well in mathematics this is generally an indicator of good mathematics teaching, although there are schools where mathematics teaching is judged to be good, but ICT is not well used. Good mathematics teaching is more common than good use of ICT in mathematics. Good mathematics teaching seems to be essential for good use of ICT in mathematics. Good use of ICT in mathematics is not essential for good mathematics teaching, but it makes it more likely. These relationships also hold true for science and English.

Mathematics, ICT use and standards

Figure 2.6 shows the relationship between ICT use in mathematics and Key Stage 2 mathematics standards. In general, 61% of schools with good use of ICT in mathematics have reached or exceeded national standards in mathematics, against 38% of schools with unsatisfactory use of ICT.

This is not just because these schools are more privileged, or have more pupils. **Figure 2.7** shows the same relationship for a sub-group of schools with average social grade and average prior attainment (grade C on both measures). Among these 'average' schools there continues to be a relationship between use of ICT in mathematics and better mathematics results.

English, ICT use and standards

Figure 2.8 shows a similar relationship between ICT use in English and Key Stage 2 English standards. In general, 62% of schools with good use of ICT in English have at or above national standards in English, against 36% of schools with unsatisfactory use of ICT.

Science, ICT use and standards

Figure 2.9 shows the relationship between ICT use in science and Key Stage 2 science standards. In general, 68% of schools with good use of ICT in science have at or above national standards in science, against 37% of schools with unsatisfactory use of ICT.

Fig 2.7 Use of ICT in Mathematics and Mathematics Attainment ('Average Schools')

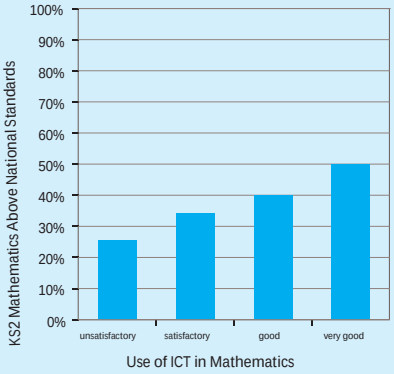


Fig 2.8 Use of ICT in English and English Achieving National Standards

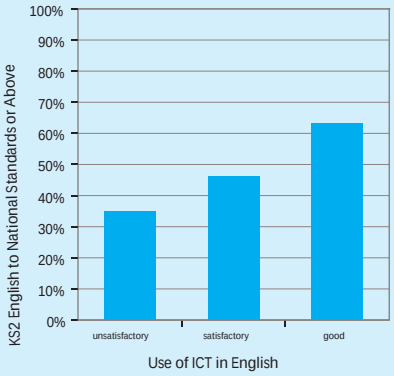
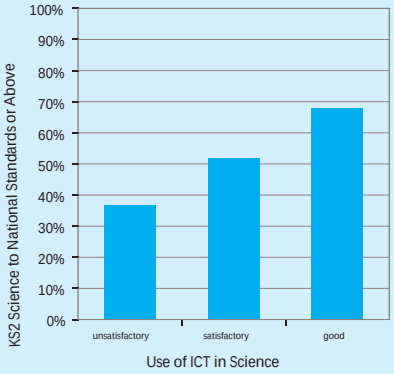
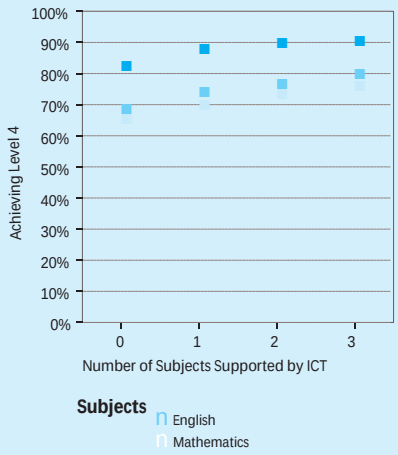


Fig 2.9 Use of ICT in Science and Science Achieving National Standards



ICT and subjects

Fig 2.10 Number of Subjects Supported by ICT and KS2 Results



All subjects

Correlations are statistical functions used to show how closely two variables are related. They vary between -1 and 1, with negative numbers showing an inverse relationship. The graph for English in **Figure 2.8** translates into a correlation of 0.29. Similar correlations for mathematics and science are 0.17 and 0.20 respectively. The use of ICT in any curriculum subject was associated with higher achievements in all core subjects. Correlations between ICT use and better results were roughly equal regardless of subject. All of these correlations are statistically significant.

Figure 2.10 shows the relationship between the use of ICT in one, two or all three subjects and Key Stage 2 results. The graph shows a marked and consistent rise in the average standards for all subjects as the number of subjects with good use of ICT increases from none to all three (English, mathematics and science). For English the increase is from 68% to 79%, with similar increases for mathematics and science. It is possible that the use of ICT in subjects is associated with better general pupil learning in the school rather than subject-specific pupil learning.

This analysis considers data at the 'whole school' level. The ImpaCT2[5] study provides an insight into how ICT impacts on the achievement of individual pupils. It found similar positive associations between individual pupils' use of ICT and their performance in Key Stage 2 national tests.

5 Reports from the ImpaCT2 study are available on the research area of the Becta web site [http://www.becta.org.uk/research/].

Conclusions

ICT learning opportunities are strongly related to good use of ICT in English, mathematics and science. This supports a view that in primary schools where the same teacher in the same classroom generally teaches ICT, English, mathematics and science, ICT capability is closely related to ICT use in subjects.

There are strong links between:

- good ICT learning opportunities
- ICT attainment
- good use of ICT in subject teaching
- attainment in other subjects.

This suggests that where pupils have good ICT learning opportunities, they apply and develop their ICT capability through their subject work, and that this relates to higher standards.

Where ICT is used well within the subject this is generally an indicator of good subject teaching, although there are obviously many schools where subject teaching is judged to be good, but ICT is not used. Good subject teaching seems to be essential for good use of ICT in that subject. Although the reverse is not essential, it makes it more likely.

There is a strong relationship between the use of ICT and subject results. 61% of schools in the sample with good use of ICT in mathematics are at or above national standards in mathematics, against 38% of schools with unsatisfactory use of ICT. The equivalent figures for English are 62% and 36%, and for science are 68% and 37%.

The use of ICT in any curriculum subject was associated with improvements in all core subjects. The more subjects ICT is used for, the better the results across all subjects.

Section 3 – A developing model

A developing model

Fig 3.1a ICT Resources and KS2 Results

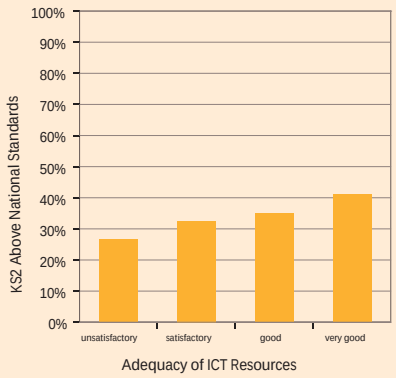


Fig 3.1b Strategic use of ICT and KS2 Results

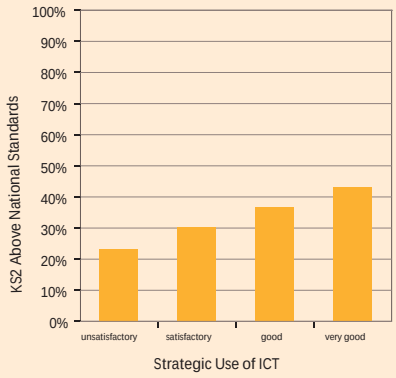
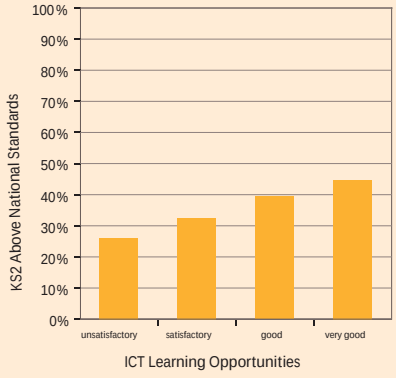


Fig 3.1c ICT Learning Opportunities and KS2 Results



The previous report proposed a chain of relationships linking ICT resources to outcomes in key stage tests and examinations, indicating that the way in which ICT resources were used was as crucial as their presence within a school.

Figure 3.1 shows some of the results of applying this model to primary schools. Whereas previous graphs in this report have compared just the 'best' and 'worst' subgroups of schools, the following figures illustrate findings across the entire range of classifications as awarded by Ofsted during 2001 inspections.

The height of the bars represent the proportion of schools getting above average Key Stage 2 results (this is the grade given by Ofsted based on the combined value of the test results at Key Stage 2 for English, mathematics, and science).

The first component of the model is **ICT resources** themselves. Clearly some level of resourcing is essential if schools are to use ICT. While, as has been seen earlier, some schools with poor levels of ICT resources are achieving good results, the evidence set out in Section One and **Figure 3.1a** illustrates a positive trend with better resourced schools achieving better results on average.

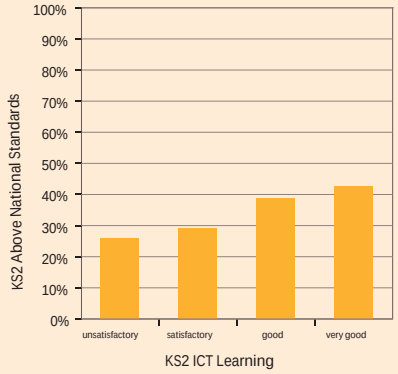
The second component of the model is **how ICT resources are deployed** within the school. Again, it is unlikely that ICT could be used to raise standards irrespective of how well the resources were deployed and this is born out in **Figure 3.1b**, which shows that above average results in Key Stage 2 tests increase as resources are more strategically deployed.

Thirdly, the ICT resources are used to provide **good ICT learning opportunities**, ensuring that pupils develop the underlying skills, knowledge and understanding set out in the Programme of Study for ICT. Again, **Figure 3.1c** shows the relationship between good ICT learning opportunities and standards at Key Stage 2, with average results increasing as the provision of good ICT learning opportunities increases.

Fourthly, (as shown in Section Two) these good ICT learning opportunities support improved **pupil attainment in ICT** (see **Figure 2.1**), allowing pupils to apply and develop their ICT capability to make good use of ICT in other subjects (see **Figure 2.2**). Clearly, a number of approaches to providing good ICT learning opportunities and good subject use are possible, ranging from discrete to integrated teaching of ICT. Based on this data, it is not possible to determine any patterns in schools' use. However, what is clear is the strength of the relationship between the two, with pupils' attainment in ICT featuring strongly in the analysis.

Section 3 – A developing model

Fig 3.1d Pupils' Improved Learning and KS2 Results



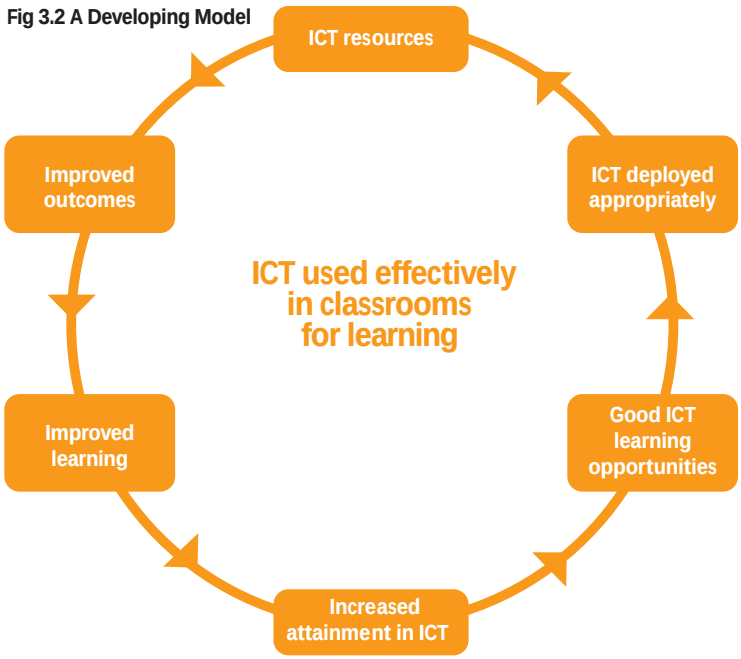
Fifthly, these good uses of ICT **improved learning** in the subject leading finally to improved outcomes (**Figure 3.1d**).

It is clear from the graphs that not only does the proportion of schools with above average standards increase as the ICT indicator improves, but that this effect is more marked for ICT indicators that are more closely linked to how well ICT is used in the classroom. Of the ICT grades under consideration, the one that is most closely linked to Key Stage 2 outcomes is the provision of ICT learning opportunities to pupils in the classroom – that is, the opportunities presented to pupils to learn the knowledge, skills and understanding set out in the Programme of Study for ICT.

It is reasonable to assume therefore that the relationship between these factors operates in the direction shown by the arrow (**Figure 3.2**), but determining cause and effect is rarely possible for statistical data and a more detailed model requires experimental data outside the scope of this research.

In summary, good ICT learning opportunities appear to play a pivotal role in translating effectively deployed resources into good subject teaching and increased attainment. Given their importance, the next section of this report identifies the conditions needed in schools if they are to provide these opportunities for learners.

Fig 3.2 A Developing Model



Conclusions

Previous statistical analysis outlined an exploratory model linking schools' ICT resources and educational standards. Using new Ofsted judgements, in particular the grade given for 'ICT learning opportunities', the report suggested that ICT resources best supported improvements in standards where they were used effectively in the classroom to support learning.

This year's report looks again at this exploratory model, and presents further analysis to demonstrate improved learning. As with previous reports, the analysis is based on statistical association and cannot prove causality, but it does give further credibility to the conclusion that the impact of ICT is crucially dependent on how it is used in the classroom.

Clearly, the proposed model needs further exploration. As part of its evidence-gathering programme, Becta will explore further the model in order to substantiate or refute the relationships suggested by the data considered in this report.

Section 4 – Schools' readiness for ICT

Schools' readiness for ICT

Sections One and Two showed that considerable variation exists between schools' use of ICT, and that while some schools have made remarkable progress, not all schools use ICT well. This section provides an analysis of the factors that need to be in place to ensure the 'good ICT learning opportunities'.

Analysis within this section examines a range of factors to identify those that are essential to the development of good ICT learning opportunities in schools. The factors are:

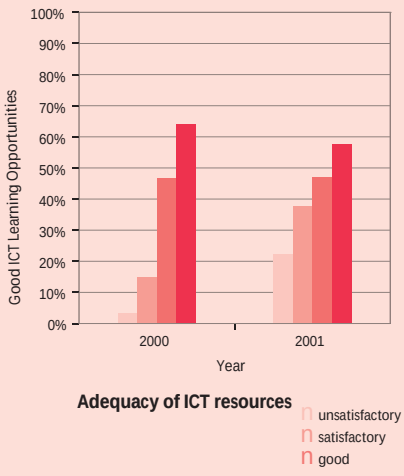
- adequacy of ICT resources
- leadership and management of ICT
- quality of ICT teaching
- leadership of the headteacher and key staff
- general quality of classroom teaching
- social grade of the school
- prior attainment of pupils.

ICT resources

Figure 4.1 shows the relationship between the adequacy of ICT resources (as judged by Ofsted) and good ICT learning opportunities. As the graph clearly shows, as ICT resourcing improves, ICT learning opportunities also improve. Some 47% of schools with good ICT resources and 58% of those with very good ICT resources provide good ICT learning opportunities.

Comparing the results for 2001 with those from last year's study, key differences are seen at the bottom end of the scale. Whereas in the previous report only 3% of primary schools that had unsatisfactory ICT resources provided good learning opportunities in ICT, in 2001 this figure has risen to 23%. This suggests that schools with low levels of ICT resourcing are striving to provide good ICT learning opportunities for their pupils.

Fig 4.1 ICT Resources and ICT Learning Opportunities



Schools' readiness for ICT

Fig 4.2 ICT Leadership and ICT Learning Opportunities

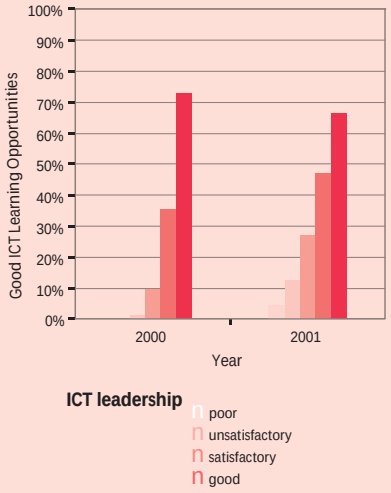
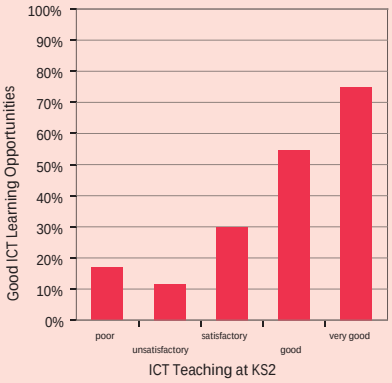


Fig 4.3 ICT Teaching and ICT Learning Opportunities



ICT leadership

Figure 4.2 shows the distribution of learning opportunities related to ICT leadership. Only 12% of schools where ICT leadership is unsatisfactory provide good learning opportunities in ICT as opposed to 47% of schools where ICT leadership is good, and 66% where ICT leadership is very good. However, when comparing this to figures in the previous report, positive improvements are typically seen across most grades of ICT leadership.

The quality of leadership and management of ICT in a school is crucial to the provision of good ICT learning opportunities. In 2001, 56% of primary schools have good or very good ICT leadership. However, it is not a sufficient factor on its own; only 47% of schools with good ICT leadership provide good ICT learning opportunities.

ICT teaching

Figure 4.3 shows the relationship between ICT teaching and ICT learning opportunities. Where the teaching of ICT is not good in a school then it is highly unlikely that pupils get good ICT learning opportunities. Where ICT teaching is good, 55% of schools provide good learning opportunities and where ICT teaching is very good, this is 75%.

The distribution of the quality of ICT teaching across the range of schools in shown in Section Seven (**see Figure 7.11a**). ICT teaching is poor or unsatisfactory in 10% of primary schools, and good or better in 55% of primary schools. This shows a very positive trend in comparison to figures for 2000, which were 34% and 31% respectively. The occurrence of poor or unsatisfactory teaching has decreased by some 24% whilst good or better ICT teaching has increased by 24%.

Good ICT teaching is important to good ICT learning opportunities, although it is not sufficient by itself.

General leadership of the school

Ofsted makes a judgement on the leadership of the headteacher and other key staff. The analysis of the quality of this leadership against good ICT learning opportunities is shown in **Figure 4.4**. This figure suggests that the quality of school leadership enables good ICT learning opportunities, with a very positive trend of good, or better, school leadership facilitating increased ICT learning opportunities in 2001.

There is a clear link between school management and ICT. Part of this is related to ICT resourcing. **Figure 4.5** shows the relationship between school leadership and good ICT resources.

The quality of leadership appears to have an impact not only on whether a school has good ICT resources but also on whether there is an improvement in standards related to ICT. **Figure 4.6** shows the relationship between standards and ICT resources, but differentiating between good or better leadership and others.

Not unexpectedly, schools with good or better leadership do better overall than those with poor leadership. Generally, schools with good leadership and very good ICT have better results than those with good leadership but poor or unsatisfactory ICT resources.

Generally, schools with satisfactory or worse leadership show little variation is standards associated with variation in ICT resources, with less than 8% differential across all grades of ICT resources.

This suggests that any increase in Key Stage 2 standards related to ICT resources is mainly occurring in schools with good or very good leadership.

Fig 4.4 School Leadership and ICT Learning Opportunities

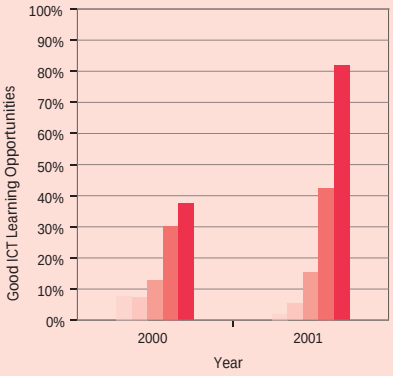


Fig 4.5 School Leadership and Good ICT Resources

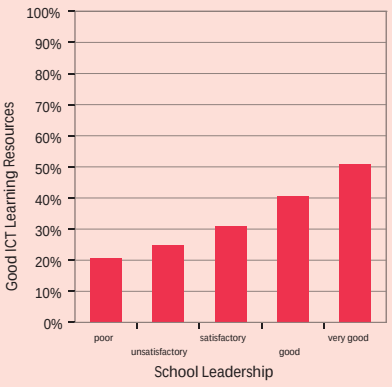
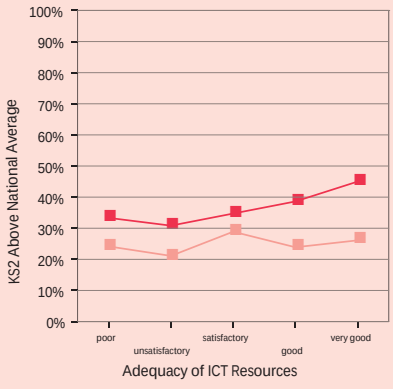
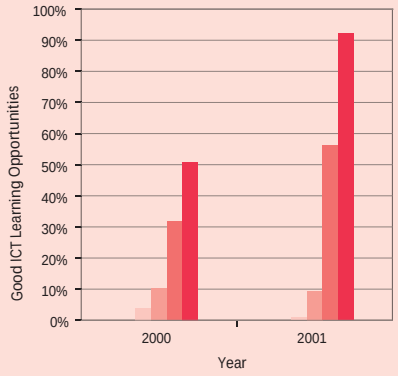


Fig 4.6 ICT Resources and KS2 Results



Schools' readiness for ICT

Fig 4.7 General Teaching and ICT Learning Opportunities



General teaching at K52

- poor
- unsatisfactory
- satisfactory
- good
- very good

Fig 4.8 General Teaching and Teachers' Understanding of ICT

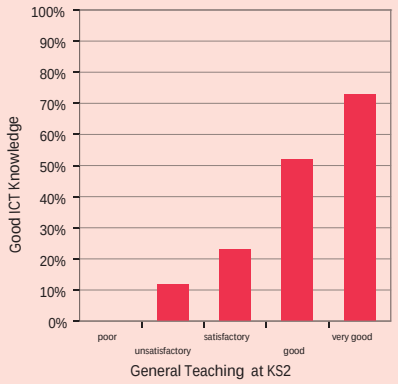
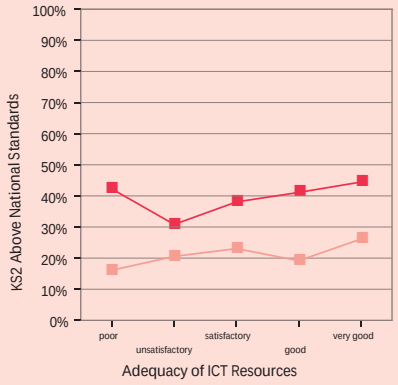


Fig 4.9 ICT Resources and KS2 Results



Good teaching - ICT enabler

- others

General teaching quality

Figure 4.7 examines the relationship between general classroom teaching and ICT learning opportunities.

The graph shows that where general teaching within a school is unsatisfactory, only 1% offer good ICT learning opportunities. Where general teaching is good or very good, ICT learning opportunities increase to 56% and 92% respectively. Large differences can be seen between figures for 2000 and 2001, particularly where teaching is good or better. This suggests that overall teaching quality is increasingly becoming key to providing good ICT learning opportunities.

While Ofsted inspectors are likely to consider good use of ICT as one component of teaching quality, it is not a dominant factor in judging the teaching quality of a school. Section Seven **(Figure 7.11b)** shows that teaching is judged to be satisfactory or better in all but 4% of primary schools, and is good or very good in 74% of primary schools.

Figure 4.8 shows the relationship between general teaching and the teachers' understanding of ICT. It shows that 74% of schools with very good general teaching, and 52% of those with good general teaching, have teachers with a good, or better, knowledge and understanding of ICT, as against 12% of schools with unsatisfactory levels of general teaching. There is, therefore, a close association between the general quality of classroom teaching and the teaching of ICT. Schools with less confident and capable teachers seem unlikely to provide good ICT teaching and good ICT learning opportunities in the classroom.

Figure 4.9 provides further evidence on this point, showing the relationship between ICT resourcing and standards but splitting the schools into two populations: those where the general level of teaching is good or better against the rest.

Not unexpectedly, schools with good teaching do better overall than others, and also schools with good teaching and good ICT resources generally get better results than those schools with good teaching and unsatisfactory ICT resources. Interestingly, a particular group of teachers appears to 'buck' this general trend.

As can be seen in the graph **Figure 4.9**, schools where teaching is good, but access to ICT resources is poor, achieve better results on average than schools where teaching is good, but ICT resources are unsatisfactory, satisfactory or good. This may reflect little more than random fluctuations in the data, or it may point to:

- the existence of schools with the lowest levels of ICT resource where good teachers are achieving high standards with little use of ICT
- schools with poor ICT resources where teachers are particularly effective at targeting the use of those resources.

Further research is needed to explore this issue.

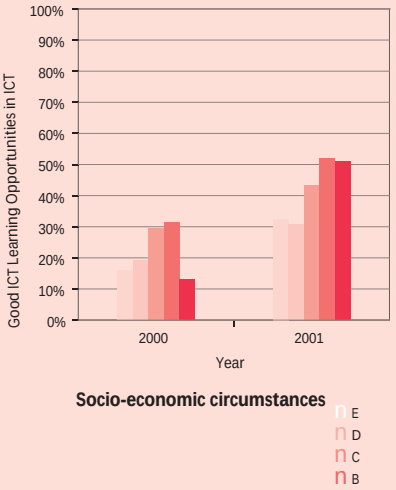
Social grade

Figure 4.10 shows that schools with higher social grades are more likely to offer good learning opportunities in ICT than those with grades D and E. Section Five shows that this is not necessarily because schools with higher socio-economic grades have better ICT resources.

When compared to figures for 2000, a more pronounced trend is apparent towards schools in the higher social grades, but irrespective of this, schools in all socio-economic grades show a considerable increase in providing good ICT learning opportunities.

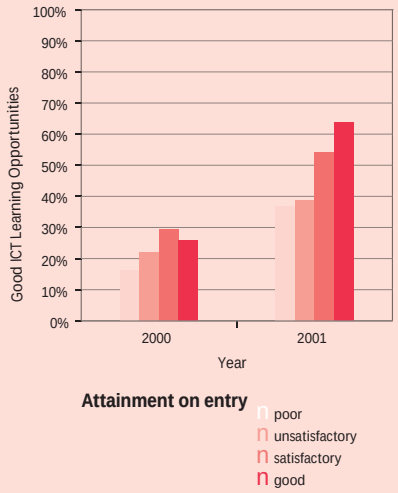
Social circumstances are not a crucial factor in determining whether schools provide good ICT learning opportunities, but there is some increase towards higher socio-economic grades. However, low social grade does not prevent schools providing good ICT learning opportunities and there are many schools in groups D and E that provide good ICT learning opportunities.

Fig 4.10 SEG and ICT Learning Opportunities



Schools' readiness for ICT

Fig 4.11 Prior Attainment and ICT Learning Opportunities



Attainment on entry

Attainment on entry is a measure of the academic ability of pupils on entering the school. **Figure 4.11** shows the relationship between attainment on entry and good learning opportunities in ICT.

In contrast to findings for 2000, there now appears to be a positive relationship between attainment on entry and access to ICT learning opportunities, with a tendency for schools serving pupils with high prior attainment to provide better ICT learning opportunities. However, there are many instances of schools that provide good ICT learning opportunities where pupils have low prior attainment.

Table 4.1 summarises the results for each of the factors.

Table 4.1 ICT enablers
(figures in brackets are based on a sample of fewer than 50 schools)

Factor	If this factor is 'unsatisfactory', how many schools offer good learning opportunities in ICT?	If this factor is 'very good', how many schools offer good learning opportunities in ICT?	Difference between 'unsatisfactory' and 'very good'
ICT resourcing	22%	58%	36%
ICT leadership	(12%)	66%	54%
ICT teaching	(12%)	75%	63%
School leadership	(3%)	75%	72%
General teaching	(38%)	89%	51%
Social grade	38%	52%	14%
High prior attainment	39%	(48%)	9%

Although social grade and high prior attainment may have an indirect relationship to the ability of schools to offer good learning opportunities in ICT, their impact is not as marked as for other factors. Of the seven factors tested therefore, the first five are considered to be important factors in enabling a school to offer ICT learning opportunities to pupils.

The number of ICT factors

The analysis has identified five factors – ICT enablers – that when judged to be good or better were necessary but not sufficient for schools to provide good ICT learning opportunities. **Figure 4.12** shows good ICT learning opportunities against the number of ICT enablers present.

The findings from last year's report pointed towards a 'threshold effect' below which schools were unlikely to provide good ICT learning opportunities. In contrast, **Figure 4.12** appears to show a linear relationship between the number of ICT enablers in place and a school's ability to offer good ICT learning opportunities to its pupils. This indicates that schools with two or three enablers in place are now more able to provide good ICT learning opportunities for their pupils.

A simple explanation for the difference between this year's and last year's findings is that teachers in schools less advanced in their overall management, teaching and resourcing, are more confident and better able to provide good ICT learning opportunities than they were, possibly as a result of additional training and support, or the adoption of ICT schemes of work. Further work is needed to test the validity of this supposition.

Figure 4.13 shows the distribution of those ICT factors present in primary schools. Some 17% of primary schools had all five enabling factors in place, and 36% had four or five. This shows an increase on last year of 10%.

How factors combine

Figure 4.13 shows how many schools have ICT-enabling factors in place. **Figure 4.14** shows the same type of relationship, but plots for each of the five groups of schools the percentage of that group that has a particular enabler in place.

Of the group of schools with three enablers, for example, 78% have good general teaching, 80% good general leadership and 71% good ICT leadership, but only 39% good ICT teaching and 38% good ICT resources.

This graph does not show change over time; it represents a snapshot of a number of populations of schools in the year 2001. However, it demonstrates a very similar picture to 2000, strengthening the findings from last year's report. Therefore a number of tentative conclusions can be drawn.

Fig 4.12 ICT Enablers and ICT Learning Opportunities

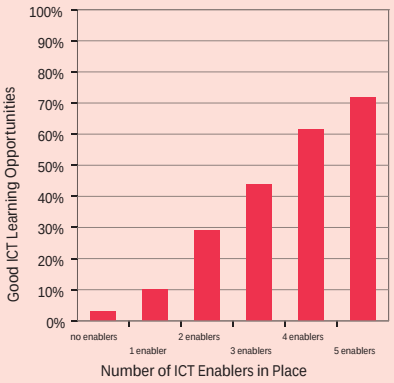


Fig 4.13 Number of ICT Enablers in Primary Schools

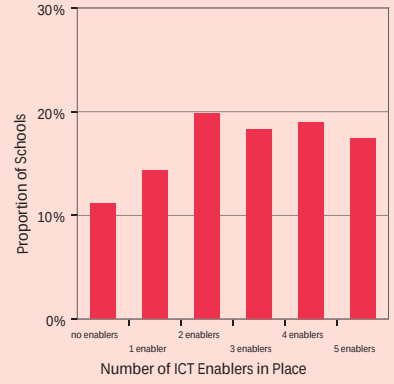
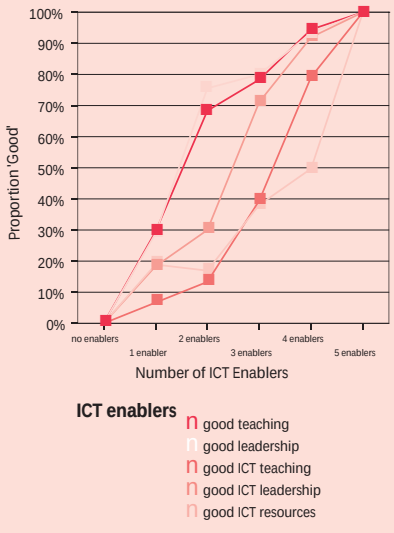


Fig 4.14 ICT Enablers



Schools' readiness for ICT

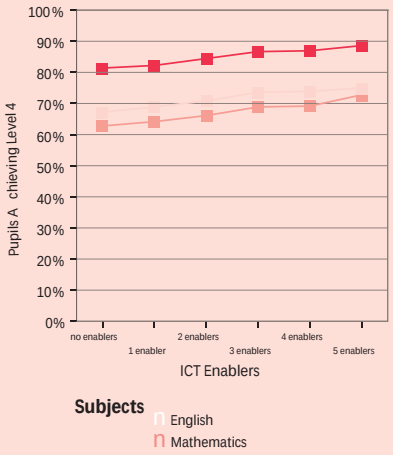
Firstly, the findings are in line with a model of ICT implementation following a relatively logical progression where schools usually have good general leadership and good general teaching in place before developing their ICT. Secondly, the development of ICT factors is also logical. ICT leadership tends to precede ICT teaching followed by ICT resources.

These results suggest that ICT implementation is relatively methodical; ICT resources are not being wasted in schools unable to take significant advantage of them. There are still significant numbers of schools that are ready to increase the quality of their ICT resources, supporting government policy commitment on spending on infrastructure. As a consequence, however, there is a necessary concern for those schools which do not have the base levels of good leadership and teaching on which to build.

ICT factors and attainment

Figure 4.15 shows the average proportion of pupils achieving Level 4 at Key Stage 2, in relation to the number of ICT-enabling factors in place. It can be seen that schools with more ICT factors in place tend to get better results. As well as any ICT factors, improvements in standards will of course come about through general teaching and leadership. However, **Figure 4.14** shows that approximately 70% of schools have both of these factors in place when they have two ICT enablers, and further improvements beyond this may be attributable to ICT factors.

Fig 4.15 ICT Enablers and KS2 Outcomes



Conclusions

This section identifies five factors (ICT enablers) that are present in the development of good ICT learning opportunities in schools. These were identified from a list of seven school and ICT factors that had the highest association with learning standards overall and together represented a context for the learning process. The five crucial factors are:

- ICT resourcing
- ICT leadership
- ICT teaching
- school leadership
- general teaching.

Two other variables – the socio-economic grades applied to the school and the prior attainment of pupils – were not found to be crucial.

The analysis showed that each of these five ICT enablers was necessary, but not sufficient by itself to provide good ICT learning opportunities. Pupils' access to good ICT learning opportunities was dependent on the overall quality of a school's general teaching and general leadership.

The presence of all five factors increases the possibility of good ICT learning opportunities and, in contrast with the previous report, there now appears to be a linear relationship between the number of ICT enablers and providing good ICT learning opportunities.

The number of schools with four or five ICT enablers in place has increased in 2000–01.

The presence of good or very good ICT resources makes good learning opportunities more likely, but whereas last year only 3% of primary schools that had unsatisfactory ICT resources provided good learning opportunities in ICT, this figure has risen to 23% in 2001. This suggests that some schools are working to provide good ICT learning opportunities for their pupils, despite low levels of ICT resourcing.

Schools with good or very good leadership were nearly twice as likely to have good ICT resources than those with poor or unsatisfactory leadership, and those with good leadership were almost three times as likely to provide good ICT learning opportunities than those which had satisfactory leadership. Schools with good leadership and good ICT had better results than schools with good leadership and poor ICT.

Schools with good or better general teaching provided far more ICT learning opportunities than those schools where general teaching was satisfactory or worse. Schools judged by Ofsted to have good general teaching had teachers with a good understanding of ICT, but those judged to be satisfactory or worse did not. Schools with good teaching and good ICT resources generally achieved better results than schools with good teaching and unsatisfactory ICT.

This suggests that most of the improvements in standards related to ICT resources were found in schools with good leadership and good teaching, although ICT leadership and ICT teaching also follow the above trends.

An analysis of the schools and the five ICT enablers showed that 17% of primary schools had all five in place. Schools with a high number of ICT enablers usually had good general leadership and good general teaching. Schools with good ICT teaching usually had good ICT leadership and schools with good ICT resources usually had all other factors in place. This confirmed the findings from 2000, and supports the conclusion that ICT implementation seems to follow a relatively logical progression. There continues to be concern, however, for those schools that do not have the base levels of good leadership and teaching on which to build.

Section 5 – Socio-economic factors

Socio-economic factors

Fig 5.1 SEG and ICT Resources in Primary Schools

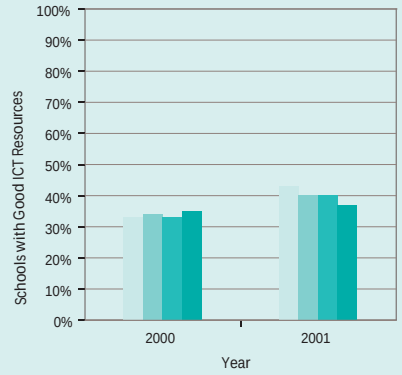


Fig 5.2 SEG and ICT Learning Opportunities

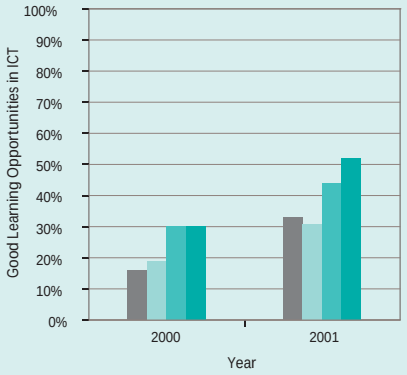
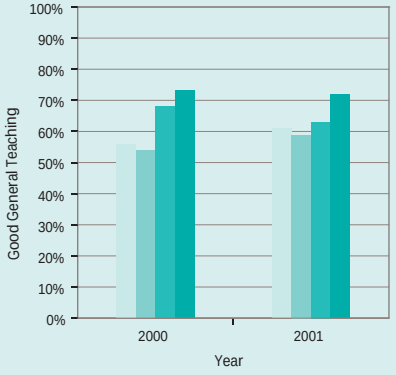


Fig 5.3 SEG and Good Teaching



SEG band

E C
D A/B

A key concern for education is the possibility of a digital divide. Various initiatives have taken place to ensure that schools in difficult circumstances have as good, if not better, ICT resources than those in better circumstances.

Distribution of ICT for schools of different socio-economic groupings

Ofsted inspectors place schools into one of seven socio-economic grades, A* to E*, based on their assessment of the nature of the catchment area. Grade A* is where the highest socio-economic grade is applied, and grade E* is the lowest grade. As very few grades A* and E* were applied to schools, these were combined with grades A and E. These grades are used in Section One to consider the relationship between socio-economic grades and performance.

Figure 5.1 shows the distribution of ICT resources across social grades. Following the trend indicated in the previous report, it is clear that there is no real difference between socio-economic group and ICT resources in primary schools. In fact, in contrast to last year's findings, schools in lower socio-economic groups are classified as having slightly better resources, possibly demonstrating the success of recent initiatives to bridge the digital divide.

However, when ICT learning opportunities are examined by socio-economic group, as shown in **Figure 5.2**, there is a clear trend for ICT learning opportunities to be better in more advantaged schools. However, there is a marked improvement in learning opportunities for all socio-economic groups, with opportunities more than doubling for those pupils in grade E.

As already demonstrated in **Figure 5.1**, the tendency for ICT learning opportunities to be better in higher socio-economic groups is not because of improved ICT resources, and so other factors must be contributors. **Figure 5.3** shows that general standards of teaching are generally slightly better in higher socio-economic bands, and this may account for some of the differences.

Socio-economic factors

Fig 5.4a Use of ICT in English and English Results

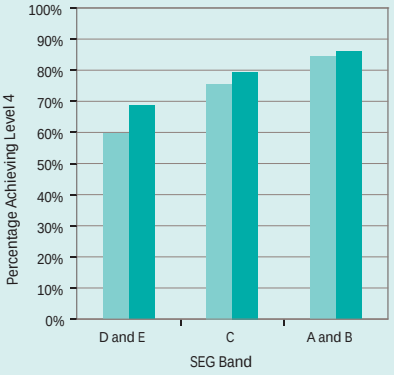


Fig 5.4b Use of ICT in Mathematics and Mathematics Results

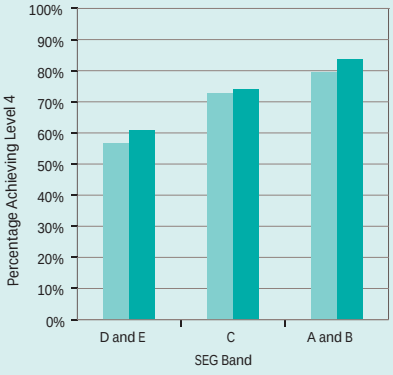
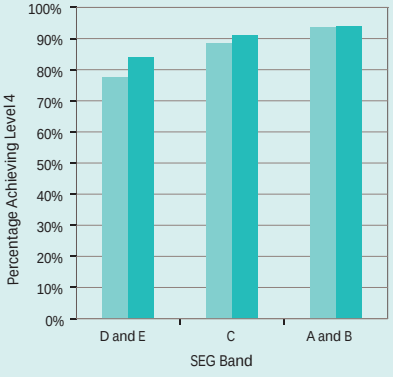


Fig 5.4c Use of ICT in Science and Science Results



Subject results for different socio-economic grades

Figure 5.4 looks at ICT usage in subjects. Again the graphs illustrate that those schools in higher socio-economic groups are likely to achieve better results. Irrespective of social grade, where a school is categorised as making good use of its ICT resources, it is likely to achieve better results than those in the same socio-economic group that do not. The trend is the same for English, mathematics, and science.

In Section Four, it was shown that there were a number of factors that needed to be in place for ICT to lead to ICT learning opportunities and improved standards. **Figure 5.5** is based only on schools in social grades D and E/E*. It shows the proportion of schools achieving above average for their socio-economic group in all three core subjects. Schools are grouped according to the number of ICT enabling factors in place.

It can be seen that schools in lower social grades are generally more likely to get above average results if the ICT-enabling factors are in place in the school.

Following the trend identified in the previous report, this analysis further supports the suggestion that schools in less favourable circumstances which are achieving above average are providing good ICT learning opportunities and have factors such as good ICT teaching, leadership and resources. The implication is that schools in less privileged areas are able to make good use of ICT and this may well lead to improved standards.

The relationship between ICT and socio-economic factors

Pupils' ICT attainment is a judgement made by Ofsted on pupils' attainment related to their ability. **Figure 5.6** shows its distribution related to pupils' prior performance.

There is no distinct trend between pupils' prior attainment on entry to primary education and resulting good ICT attainment. Interestingly, those pupils with poor prior attainment have achieved a slightly higher level of good or better ICT attainment then those with satisfactory or good prior attainment. This perhaps reflects a motivational influence of ICT for effective engagement of pupils. However, to establish this would require further research.

As **Figure 5.7** illustrates, there is again no real relationship between socio-economic group and ICT attainment.

In conclusion, ICT attainment can be as positive in schools in disadvantaged areas and for all levels of abilities, as for those more privileged schools, or for pupils who have previously had high achievements.

Fig 5.5 ICT Enablers and KS2 Above SEG Average (Grades D and E/E*)

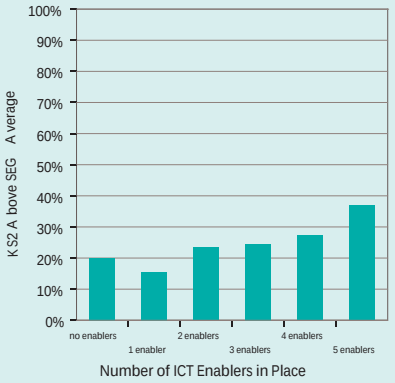


Fig 5.6 Prior Attainment and ICT Attainment

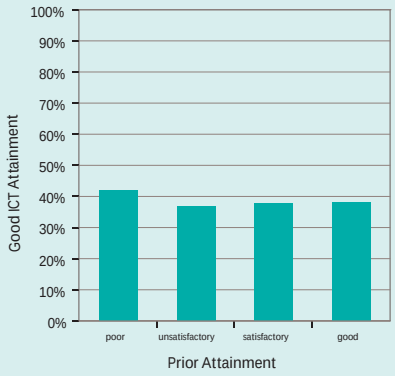
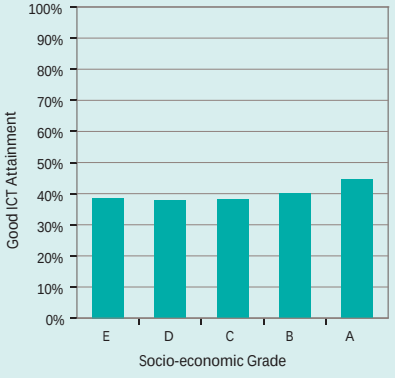


Fig 5.7 SEG and ICT Attainment



Socio-economic factors

Fig 5.8a ICT Attainment and English Pass Rate

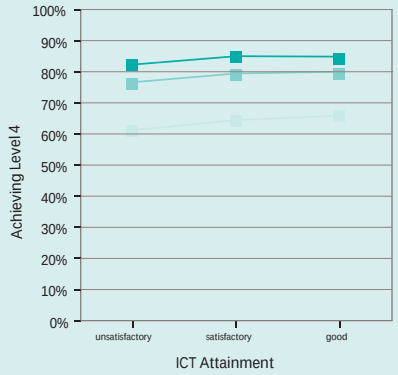


Fig 5.8b ICT Attainment and Mathematics Pass Rate

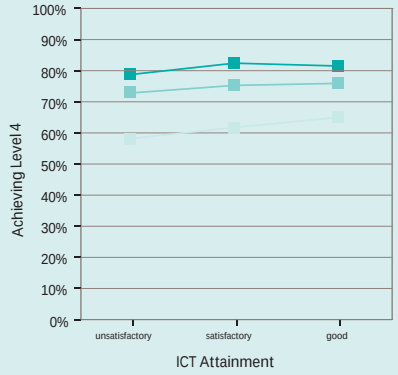


Fig 5.8c ICT Attainment and Science Pass Rate

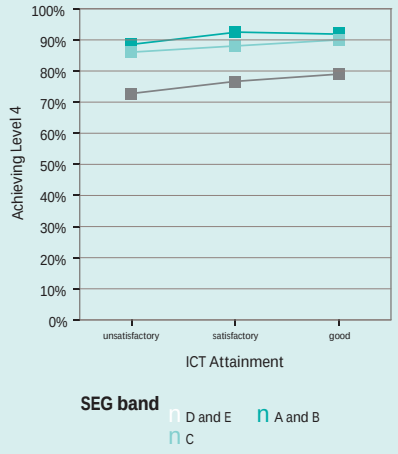


Figure 5.8 shows the relationship between pupils' ICT attainment and standards in each of the core subjects. Generally, as the overall pupil ICT attainment of a school increases, so do standards in socio-economic categories C, D and E. The trend is slightly more pronounced for schools in less favourable circumstances. However, the same is not generally true for socio-economic categories A and B. To determine possible causes would require further research.

Conclusions

Following trends identified in the previous report, there continues to be no notable difference in ICT resources between schools in different socio-economic circumstances. In fact, in comparison to last year, less advantaged schools now appear to have slightly better resources than those more privileged, perhaps demonstrating the success of recent initiatives to bridge the digital divide.

While schools in higher social grades continue to offer slightly better ICT learning opportunities than others, analysis for 2001 shows a marked improvement in ICT learning opportunities for all socio-economic circumstances, with opportunities more than doubling in those schools in low social grades.

Pupils' ICT attainment was generally independent of socio-economic circumstances, and likewise ICT attainment was generally independent of pupils' prior attainment.

Generally, there was a positive relationship between good ICT attainment and improved standards in English, mathematics, and science, with those schools in less favourable circumstances showing a slightly more pronounced trend.

Section 6 – Other positive outcomes

Other positive outcomes

While a key focus for this research has been to analyse the relationship between ICT and standards, it is also important to look at other outcomes, in particular pupil attitudes, behaviour and attendance, and parental views of the school. These are important in their own right, but also have a secondary link to improved standards. It is clear that pupils who are well motivated, with parents who are supportive of the school, are likely to be more effective learners than the reverse.

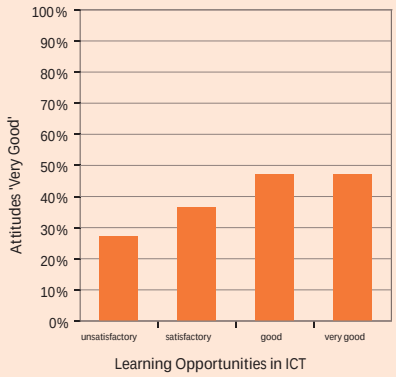
Pupils' attitudes

Ofsted inspectors make a judgement on pupils' overall attitudes to school based on their observation in lessons and of the school generally. **Figure 6.1** shows a positive relationship between the adequacy of learning resources and pupils' attitudes. Likewise, there is a positive relationship between pupils' attitudes and the quality and range of ICT learning opportunities offered to them.

These relationships need to be treated cautiously, however. As seen earlier, schools with good leadership and good teaching are more likely to have better ICT resources and offer better ICT learning opportunities, and generally foster an enhanced school ethos. The trend seen here indicates the possibility of motivational benefits of ICT, but further research and analysis is required.

Fig 6.1a ICT Resources and Pupils' Attitudes

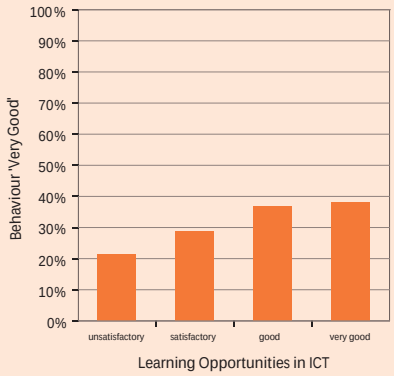
Fig 6.1b ICT Learning Opportunities and Pupils' Attitudes



Other positive outcomes

Fig 6.2a ICT Resources and Pupil Behaviour

Fig 6.2b ICT Learning Opportunities and Pupil Behaviour



Pupils' behaviour

Figure 6.2 shows the relationship between very good behaviour and ICT resources. While the incidence of very good behaviour is lower when ICT resources are unsatisfactory, a much flatter pattern is seen when ICT resources are satisfactory, good or very good than for pupils' attitudes (**Figure 6.1a**). However, when ICT learning opportunities are also considered a more positive relationship is apparent.

As with pupil attitudes, the relationships shown between ICT and pupil behaviour also need to be treated cautiously. Whilst it is unlikely that improved ICT resources and learning opportunities alone cause an improvement in pupil behaviour, the trend seen here is perhaps again an indicator of the motivational benefits of ICT.

Parental views

Ofsted also makes judgements about parents' views of schools based on their observations and meetings with parents. Parental views of a school tend to improve with the adequacy of ICT learning resources, as demonstrated in **Figure 6.3**. This further increases as the quality and range of ICT learning opportunities improves, with 58% of parents viewing the school as very good when ICT learning opportunities are deemed very good. There is a slight increase year on year when figures for 2000 and 2001 are compared. This perhaps indicates an increased recognition by parents of the importance of ICT learning opportunities in the school environment, but further research would be necessary to establish this.

As with pupils' attitudes and behaviour, a similar caution needs to be added to the interpretation of this data, as there are numerous other factors which can influence parental views of a school.

Fig 6.3a ICT Resources and Parents' View of School

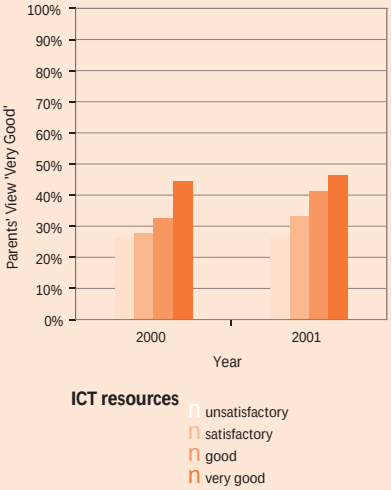


Fig 6.3b ICT Learning Opportunities and Parents' View of School

Other positive outcomes

Fig 6.4a ICT Resources and Attendance

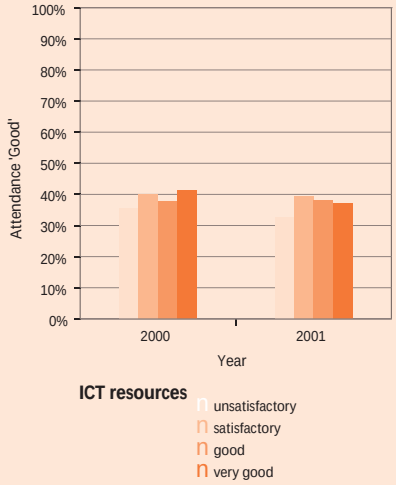
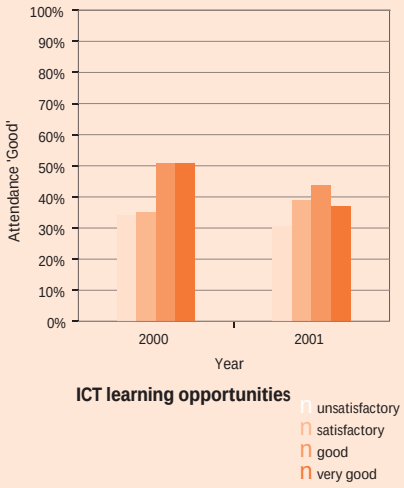


Fig 6.4b ICT Learning Opportunities and Attendance



Attendance

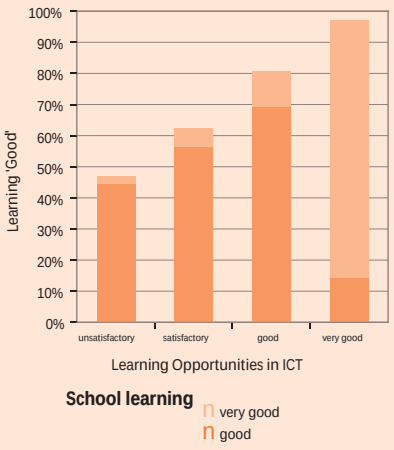
There is very little relationship between ICT resources alone and attendance, as demonstrated in **Figure 6.4**. However, when ICT learning opportunities are considered, a trend starts to emerge. Attendance tends to improve as the quality and range of ICT learning opportunities improve, mirroring the findings from 2000. However, the pattern is not as pronounced as that of last year.

Learning

Figure 6.5 shows the relationship between ICT and the judgement of Ofsted of the quality of Key Stage 2 learning. Instances of good learning increase as ICT resources improve and likewise where the quality and range of learning opportunities increases. Learning is good or better in 80% of schools with very good ICT resources, and 92% of schools with very good ICT learning opportunities, although there is probably a considerable degree of overlap between these two judgements.

Fig 6.5a ICT Resources and KS2 Learning

Fig 6.5b ICT Learning Opportunities and KS2 Learning



Other positive outcomes

Fig 6.6a ICT Resources and ICT Skills

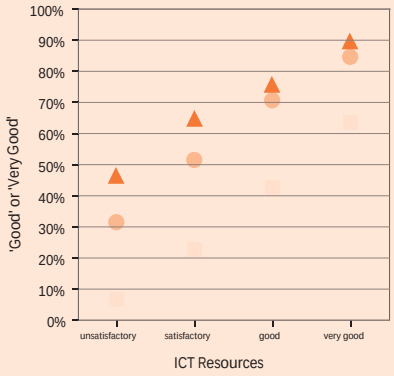


Fig 6.6b Strategic use of ICT and ICT Skills

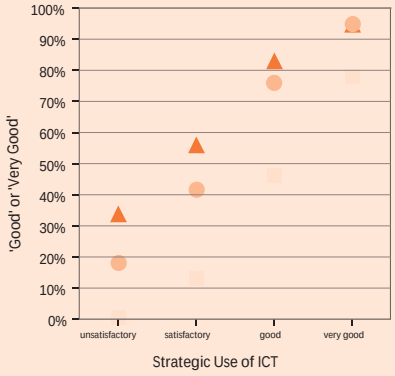
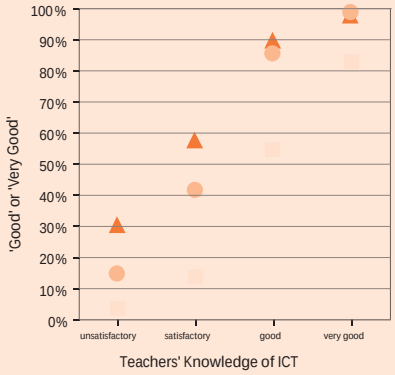
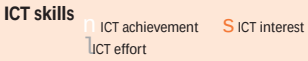


Fig 6.6c Teachers' Knowledge of ICT and Pupils' ICT Skills





Pupils' ICT skills

Pupils' ICT skills are an important outcome of ICT use in schools. ICT attainment, pupils' intellectual and creative effort, and their general interest and enthusiasm are three key factors in general ICT skills development.

Figure 6.6a shows the relationship between these three positive factors and the quality of ICT resources in school. There is a dramatic positive relationship. Schools with good or very good ICT resources are much more likely to have pupils with good or very good effort, attainment, and interest in ICT.

Figure 6.6b shows the relationship of these factors to the strategic deployment of ICT resources within the school. Where ICT resources, of whatever quality, are well used, pupils are much more likely to show effort and interest, and produce good work in ICT.

Figure 6.6c shows the relationship with the grade awarded by Ofsted for teachers' understanding of ICT. In schools where teachers have a good or very good understanding of ICT, pupils are much more likely to take an interest in ICT, make a good effort in ICT, and produce ICT work of a good standard.

Comparing figures for 2000 and 2001, there is a general improvement in achievement and effort year on year, but the same trend is not generally seen for ICT interest. This could indicate that there is perhaps more work to be done in engaging those pupils who currently feel disenfranchised from ICT use.

Pupils' efforts and interest in ICT, and the standard of ICT work seen, is not entirely related to factors that are external to the school. Schools with good resources, good deployment of resources, and where teachers have good ICT skills, tend to encourage the development of ICT skills among pupils.

Pupils' ICT skills and attainment

Figure 6.7 shows that these factors have a positive association with good educational outcomes at Key Stage 2. Schools where pupils make an effort in ICT lessons, take an interest in ICT, and produce a high quality of work in ICT also tend to obtain good results in other subjects. One possible explanation for this association is that better effort in ICT, and higher standards of ICT work, are entirely the result of social factors. For example, pupils in more privileged schools tend to gain better grades for effort and attainment in all subjects.

Fig 6.7a Pupils' Interest and KS2 Results

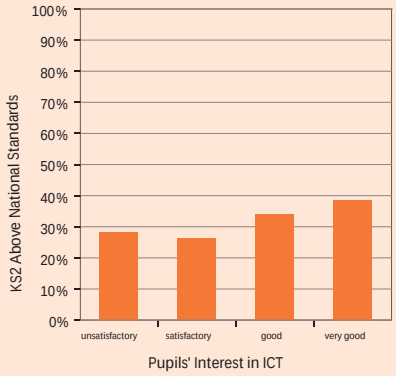


Fig 6.7b Pupils' Effort and KS2 Results

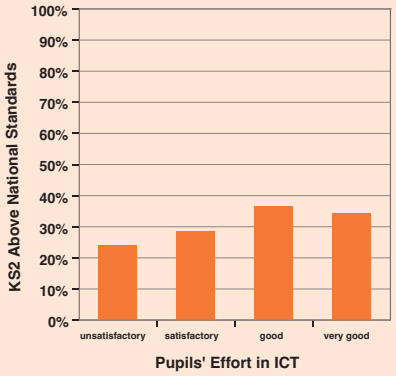
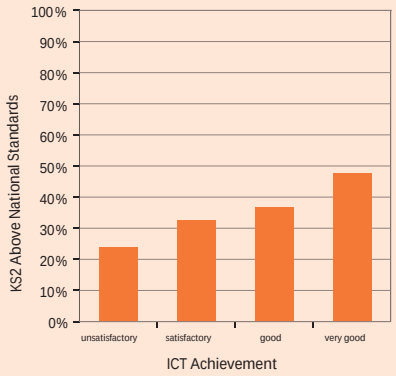


Fig 6.7c ICT Achievement and KS2 Results



Other positive outcomes

Fig 6.8a Pupils' Achievement in ICT and KS2 Above SEG Average

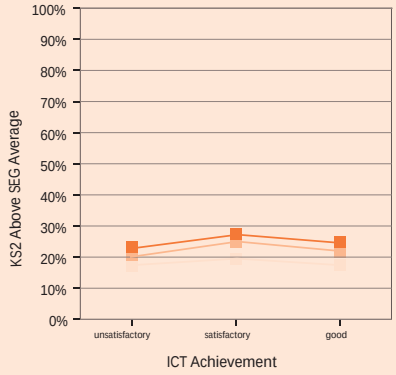


Fig 6.8b Pupils' Effort in ICT and KS2 Above SEG Average

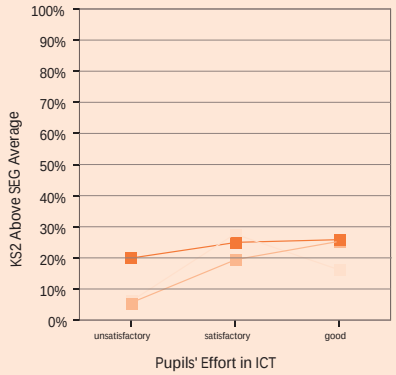


Fig 6.8c Pupils' Interest in ICT and KS2 Above SEG Average

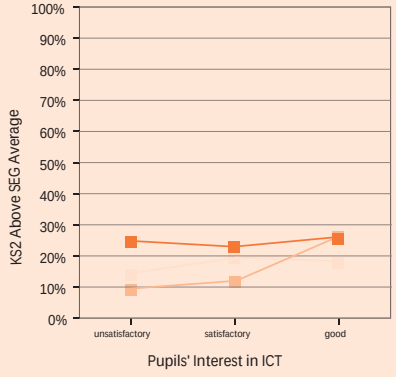


Figure 6.8 shows schools' educational attainment in comparison to other schools of the same social grade.

A tentative conclusion is that schools tend to achieve better results than schools in the same socio-economic circumstances, if pupils show interest and enthusiasm in ICT lessons, make a good effort in ICT, and produce ICT work of a good standard.

The positive relationship between ICT grades, and pupils' behaviour, attitudes and attendance and parental views, suggest that there is an association between good use of ICT in schools, and better motivation of pupils and parents, and this supports improved school ethos and improved learning. There is likely to be a degree of overlap between these different Ofsted judgements and they are all likely to be related to each other.

Conclusions

Pupils in schools with very good ICT resources were generally judged to have better attitudes and behaviour than those with poor or unsatisfactory ICT resources. The relationship was stronger if ICT learning opportunities were also considered.

In schools with good ICT resources, the attitude of parents towards the school were generally judged to be better than those in schools with poor or unsatisfactory ICT resources. This relationship was again stronger if ICT learning opportunities were also considered.

While these findings suggest an association between good use of ICT in schools and the motivation of pupils and parents, they should be treated cautiously, as many other factors such as good leadership and good teaching could have an impact. Further research is needed to demonstrate that good ICT could help to develop good school ethos and home links, and vice versa.

There is a strong relationship between pupils' attainment, effort and independence in ICT and the quality of ICT resources, their strategic use and teachers' understanding of ICT. However, whereas achievement and effort has improved year on year, the same trend has not been seen for pupils' interest. This suggests that there may be more work to be done in engaging those pupils who currently feel disenfranchised from ICT use. This work could further help to bridge the digital divide.

Section 7 – The variation between schools

The variation between schools

Fig 7.1 ICT Resource Grades

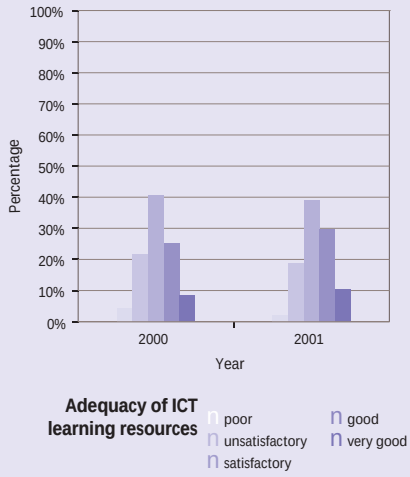


Fig 7.2 KS2 Mathematics and ICT Resources

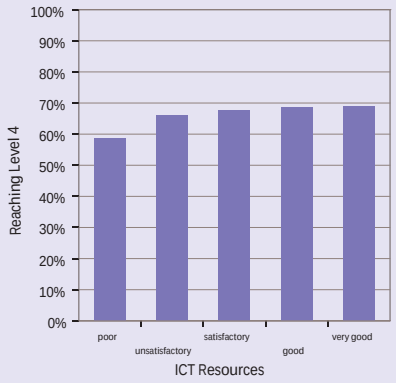
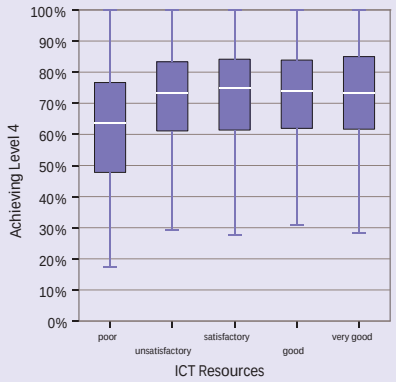


Fig 7.3 Distribution of Pass Rates Around Median Value



This section looks at the whole population of schools and analyses how they differ in their ICT factors and what relationship this has to standards.

The variation of ICT resource levels

Demonstrating a similar trend identified in previous reports, **Figure 7.1** shows the overall distribution of Ofsted judgements on the quality of ICT resources. Some improvements are apparent with more schools having good or very good ICT resources, and less with unsatisfactory or worse.

Figure 7.2 shows the average proportion of pupils achieving Level 4 in mathematics in 2001, for the group of schools defined in **Figure 7.1**. This shows that Key Stage 2 results tend to be very slightly higher for those schools with satisfactory or better ICT resources. Results are similar for English and science.

Figure 7.3 shows a 'boxplot', illustrating the full range of values from which the averages in **Figure 7.2** were obtained. Some 50% of schools fall into the range shown by the boxes, around a median value. The lines above and below the boxes indicate the full range of variation.

In each group of schools, defined in terms of ICT resources, there is a wide variation in the actual results obtained. Although on average schools with very good ICT tend to do better than those with poor ICT, there are many individual schools that do not follow this pattern. This is partly because of the effect on Key Stage 2 results of other factors that have nothing to do with ICT. However, some of the variation in results may be explained by differences in the way resources are used. The population of schools with 'very good ICT resources' includes schools where the resources are well used, and other schools where use of resources is unsatisfactory or poor. It has been shown that there is a substantial variation in results associated with these differences in use.

The variation between schools

Fig 7.4 Strategic Use of ICT Resources

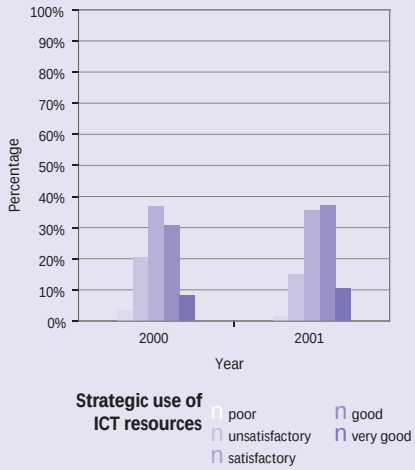
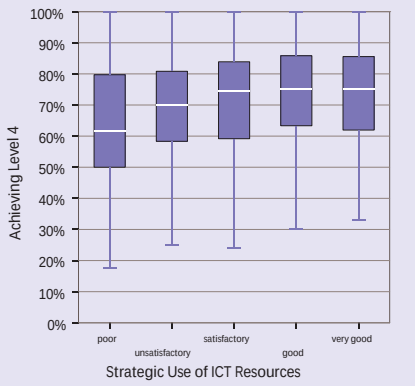


Fig 7.5 KS2 English and Strategic Use of ICT Resources

Fig 7.6 Distribution of Pass Rate Around Median Value



The variation of the strategic use of ICT resources

Figure 7.4 shows the distribution of grades given for the strategic use of ICT resources. In 16% of schools, the strategic deployment of ICT is poor or unsatisfactory. This includes many schools with good resources. However, there is a positive shift for 2001, with more schools scoring good or better and less scoring unsatisfactory or poor in this respect.

Figure 7.5 shows the average pass rate in English associated with each grade given for strategic use of ICT resources. Following a similar trend to the previous report, there is a slight improvement in Key Stage 2 English standards as the strategic use of ICT resources improves. Similar results are seen for science and mathematics.

Figure 7.6 shows the distribution of Key Stage 2 English results around the median. As with ICT resources, schools with very good strategic use of ICT tend to do better than where strategic use is poor. Again, many individual schools do not follow this pattern.

The variation of ICT learning opportunities

Figure 7.7 shows the distribution of grades given for ICT learning opportunities. Although there are only 2% of schools that are judged by Ofsted to offer poor learning opportunities, there are 24% that are judged to be unsatisfactory. However, as with **Figure 7.4**, the graph illustrates a positive shift in 2001 with more schools scoring satisfactory or better, and fewer schools scoring unsatisfactory or worse.

Figure 7.8 shows the average pass rate in English associated with each ICT learning opportunities grade for 2001. There is a slight increase in the average Key Stage 2 school results as the quality of ICT learning opportunities increases.

Figure 7.9 shows the distribution of Key Stage 2 results around the median. This follows the trends already seen in the boxplots in **Figure 7.3** and **Figure 7.6**.

Fig 7.7 ICT Learning Opportunities Grades

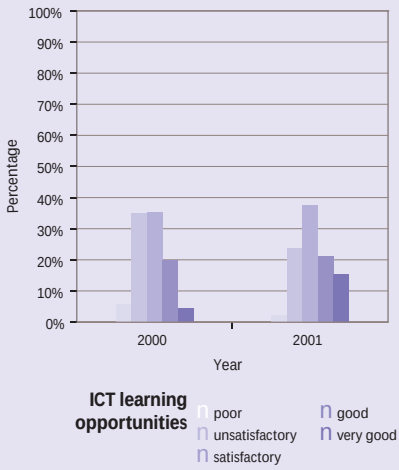


Fig 7.8 KS2 English and ICT Learning Opportunities

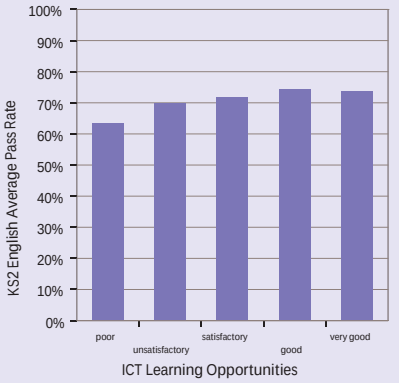
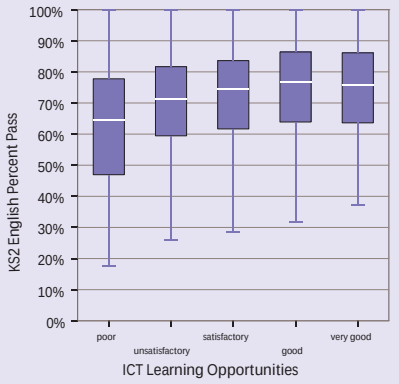


Fig 7.9 Distribution of Pass Rate Around Median Value



The variation between schools

Fig 7.10a ICT Leadership Grades

Fig 7.10b School Leadership Grades

The variation of ICT leadership

Figure 7.10 shows the distribution of grades given for leadership and management of ICT, and overall school leadership. Grades for ICT leadership vary more than grades for general school leadership, with fewer schools achieving high grades for ICT leadership. However, when comparing results for 2000 and 2001 a positive shift can be seen with more schools scoring good or very good, and fewer schools scoring unsatisfactory or worse.

The variation of ICT teaching

Figure 7.11 shows the distribution of grades given for ICT teaching compared to general teaching. It is clear that there is a much wider variation for ICT teaching, with lower grades generally being assigned than for general teaching. However, if figures for 2000 and 2001 are compared a positive trend is shown. In 2001 just 10% of schools received an 'unsatisfactory' or 'poor' grade for ICT teaching, compared to 35% in 2000. Instances of 'very good' ICT teaching have increased from 3% to 19% over the same period.

Conclusions

The variation seen between schools in relation to ICT variables is large, and greater than for many general school factors. ICT resources continue to vary between schools, with more schools having good or very good resources than in previous years.

There is considerable variation in key stage attainment between individual schools in each band, and although this is least when ICT learning opportunities are very good, this is less noticeable than last year. This suggests that the combination of ICT resources, their strategic use, and ICT learning opportunities are equally important.

Grades for ICT leadership vary more than general school leadership, with fewer schools achieving high grades for ICT leadership. However there is a distinct improvement upon the previous year report, with more schools scoring good or very good, and fewer schools scoring unsatisfactory or worse for their ICT leadership. A similar trend is shown when ICT teaching is compared to general teaching.

The differences between schools are large, which may reflect the variation in the quality of use of ICT as well as other factors. Although there have undoubtedly been improvements in 2001, there is a continued need to improve the quality of ICT leadership, ICT teaching and ICT use in the classroom in order to reduce further these differences.

Fig 7.11a ICT Teaching Grades

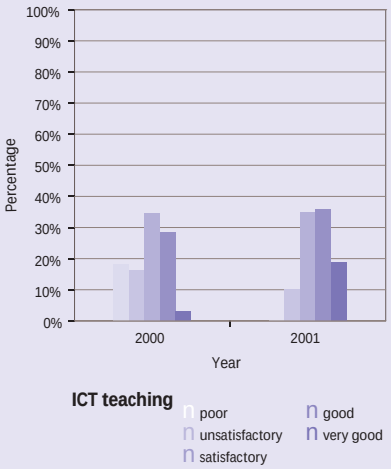


Fig 7.11b Teaching Grades

Appendices

Appendix 1 - Ofsted framework

Since January 2000, Ofsted have used a new inspection framework. Two forms of inspection are carried out: a 'full' inspection, on the majority of schools, which includes a detailed inspection of ICT features and facilities; and a 'short' inspection which takes much less time and records only the general features of a school, and does not include inspection of ICT factors. Schools are selected for short inspection on the following criteria:

'Their previous inspections were good, they have good test and examination results compared to national standards, and to similar schools, with positive trends over time.'

The change in the inspection framework has had an impact on:

- the number of schools available as a research sample
- the type of schools included in the research sample.

Impact on the number of schools

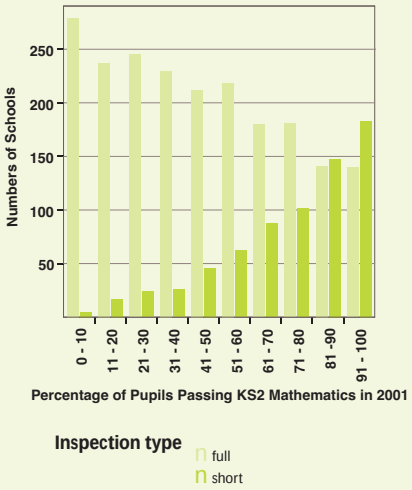
A short inspection provides no data on ICT factors and these schools were therefore removed from the analysis, reducing the sample by 24%.

Table A.1

	Primary
Total inspected	3403
Given full inspection	2582
Given short inspection	821

Appendix 1 - Ofsted framework

Fig A.1 Schools Results for KS2 Maths in by Inspection Type



Impact on the type of schools

The Ofsted criteria for short inspection removed a significant number of successful schools from the sample. As an example, **Figure A.1** shows the effect on the distribution of Key Stage 2 mathematics results.

This had an impact on the overall achievement of the sample as shown in **Table A.2**. The 'long' inspection schools achieved significantly lower average attainment in Key Stage 2 mathematics and English and, unlike schools given a short inspection, are yet to reach national targets.

Table A.2

	KS2 English	KS2 Mathematics
Average attainment rate (all schools)	75%	72%
Average (short inspection)	86%	84%
Average (long inspection)	72%	68%
Target for 2002	80%	75%

Comparison with previous reports

As with the report published in January 2002, the data analysed in this report is based on the new Ofsted inspection framework, and indicators of academic performance tend to show lower standards overall than in the years prior to 2000 when analysis was made of data for all schools inspected. This is also true for sub samples (for example, schools with good ICT resources).

Previous Becta research has demonstrated that high achieving schools are more likely to have good ICT features and the removal of more successful schools will tend to underestimate the effect of ICT. Whereas in the past Becta has identified a cohort of 'Schools of the Future', data is generally no longer available on these.

Additional judgements

Additional judgement criteria are now part of the Ofsted inspection framework, and many of these offer useful perspectives on the ICT features of schools. These are referred to within the body of the text where appropriate.

Appendix 2 - The sample

The data

Data was obtained from Ofsted and QCA on all of the 4,043 schools inspected in the academic year 2000-01. Of these 2,816 were primary schools with pupils taking Key Stage 2 tests, and 595 were secondary schools covering Key Stages 3 and 4. The remainder were schools such as infant schools and special units which fall outside of the parameters of this research. As explained in Appendix 1, ICT data was not collected for 821 schools given the 'short' Ofsted inspection.

Ofsted data

The analysis used the grades awarded by Ofsted inspectors to schools inspected in the academic year 2000-01. During an inspection, inspectors record judgements on a large range of measures. Generally, each is judged on a seven-point scale:

A* - Excellent

A – Very good

B – Good

C – Satisfactory

D – Unsatisfactory

E – Poor

E* - Very poor

Because grades A* and E* were rarely awarded, these two grades are amalgamated with the next nearest categories to give five grades A- E producing a more valid statistical sample.

QCA data

Data was obtained from QCA on the national tests at Key 2 and 3, and GCSE examinations taken in the summer of 2001.

QCA test results were used in two ways:

- The number of pupils reaching national target levels was divided by the total number of pupils taking the test, to give a percentage pass rate for the school.
- The number of schools achieving above national standards in each test was divided by the total number of schools, to give a percentage pass rate above national standards.

The attainment targets used were:

- Level 4 or above at Key Stage 2
- Level 5 or above at Key Stage 3
- 5 or more GCSEs (grade C or above) at Key Stage 4.

Conclusions

Data was obtained from Ofsted and from QCA on all of the 4,043 schools inspected in the academic year 2000-01. Of these 2,816 were primary schools with pupils taking Key Stage 2 tests, and 595 were secondary schools, the rest were schools outside the parameters of this research. Of schools within the parameters of the research, 2,582 primary schools and 465 secondary schools were given a full inspection, including ICT grades, and these schools therefore form the basis of the current research.

Appendix 3 - Statistical data and correlations

This report was reviewed by Dr Daniel Muijs, lecturer in Quantitative Research Methods at the Institute of Education of the University of Warwick, who provided this statement: "We agree that the analyses have been properly conducted and reported, and that the findings follow from the data, with the proviso that there are obvious limitations to the use of school level inspection data. We believe that this report provides a good basis for further discussion and research on the effectiveness of ICT use."

A note on line graphs

In this report, where it is necessary to compare several different sets of figures in the same chart, the decision has been made to present this information in the form of a line graph to facilitate clarity and comparison. However, this does not imply that the variables under consideration (Ofsted grades given for various features) represent continuous variation. For this reason broken rather than continuous lines are used.

A note on correlations

Correlation coefficients, relating to every relationship described in this report, are in a separate report available from the research area of the Becta web site [http://www.becta.org.uk/research/]. All correlations are statistically significant to at least 95% confidence, except those explicitly defined as not significant, by enclosure in brackets, for example (0.03).

www.becta.org.uk/research

This report, and others in the series, may be downloaded in electronic form from the research area of the Becta web site [http://www.becta.org.uk/research/].

Other reports on ICT and education are available from Becta in printed form.

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ISBN 00000000000 Print code 000000