National Audit Office

DEPARTMENT FOR CHILDREN, SCHOOLS AND FAMILIES

Mathematics Performance in Primary Schools: Getting the Best Results

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SUMMARY

1 Understanding basic mathematics is an essential life skill. This examination of mathematics performance in primary schools was undertaken because of the importance of pupils gaining a solid grounding in mathematics. Pupils who master mathematics in their early school years are in a good position to progress to further studies, including in other subjects which require a good grasp of mathematics. Those who do not are generally less able to make progress and are likely to be disadvantaged in the labour market. Our analysis of pupils' achievement shows a strong link between succeeding early and continuing to succeed. Of those pupils who did not reach the expected performance level in mathematics and English by the end of primary school, only three per cent achieved the Government's target of five GCSEs at A*- C including mathematics and English by age 16.

2 Since the late 1990s, the Department for Children, Schools and Families (the Department) has had a specific Strategy aimed at improving performance in primary mathematics which, along with its strategy to improve primary literacy, cost £207 million to implement in 2007-08. The Strategy aims to raise performance through extensive teaching and learning resources, which have been web-based since 2006, supported by training and professional development programmes for teachers. In 2007, the Department commissioned Sir Peter Williams to undertake an independent review of the quality of primary mathematics teaching and his report was published in June 2008. Our work has been informed by Sir Peter Williams' review, and by the work of the Office for Standards in Education (Ofsted) and the experts named in paragraph 13 of our methodology at Appendix 1.

3 Drawing on their evidence on teaching quality and good pedagogical practice, we have evaluated performance in primary mathematics and the impact of the Strategy and related interventions, which entailed detailed examination of data on pupil performance and characteristics, and of qualitative data on how the Strategy is being implemented. In particular this report evaluates the Department's performance in:

- raising attainment and progress in mathematics and narrowing achievement gaps between certain pupils and their peers; and
- the delivery and effectiveness of the Primary National Strategy's resources and interventions and their impact on pupil and school performance.

In the last part of the report, we identify what more the Department, local authorities and primary schools can do to raise performance in mathematics.

4 To inform our findings we conducted independent statistical analyses of national performance data, and validated and used some of the Department's data and analysis. We visited and surveyed 28 primary schools around England representing a range of school sizes and intakes. To illustrate good practice, the majority of the schools we selected had a strong performance in mathematics, but for comparative purposes, a minority of those we selected were schools where mathematics teaching had been identified as a weakness. We surveyed more than 1,000 pupils in their first two years of secondary school to ask for their reflections on learning mathematics at primary school and the transition to secondary. Appendix 1 gives further details of our methodology.

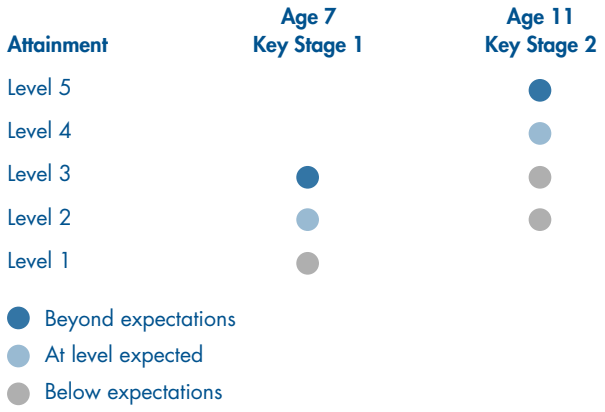
Main findings

5 Primary school pupils aged 5 to 11 are taught a broad range of subjects within the National Curriculum, with a focus on the core subjects of mathematics, English and science. Appendix 2 illustrates what pupils typically learn in mathematics and are assessed on during their primary education. On an average school day, teachers spend about an hour teaching mathematics (around 20 per cent of total teaching time) as well as encouraging pupils to develop and apply their mathematical skills in other subjects. Mathematics teaching in primary schools can stretch across all subjects of the primary curriculum, emphasising its relevance to almost all aspects of daily life. Based on the average teaching time devoted to the subject, we estimate that some £2.3 billion was spent on teaching mathematics in primary schools in 2006-07 out of a total expenditure of £10 billion on primary teaching and teaching support staff.

6 The National Curriculum sets standards of achievement. At primary school, standards range between level 1 and 5, with pupils expected to achieve certain levels by the end of the Key Stages **(Figure 1)**.

1 Primary school levels of attainment and expectations at Key Stages 1 and 2

Most 7 year olds are expected to attain level 2; most 11 year olds are expected to attain level 4



Source: Department for Children, Schools and Families

NOTE

Levels of attainment, reported annually, are based on:

- teachers' assessments of pupils' progress at age 7, underpinned by compulsory national tests;
- the results of national tests for pupils at age 11.

Pupil attainment and achievement in primary mathematics

7 After significant early increases, improvements in attainment in primary mathematics have slowed in recent years. Pupils reaching the expected standard at Key Stage 2 (age 11) rose from 59 to 72 per cent between 1998 and 2000 **(Figure 2)**. Since 2000 the trend has, however, levelled off, with continuing small increases in most years at Key Stage 2. At Key Stage 1 (age 7) the proportion of pupils reaching the expected standard has remained at around 90 per cent. In 2007 nearly a quarter of pupils did not reach the expected standard before entering secondary school. Some six per cent (34,000) of these 11-year-olds had only acquired mathematical skills at or below those expected of a seven-year-old.

8 The Department has not met its key performance target for the last spending round and meeting its targets for 2011 will be a considerable challenge. The 2007 Key Stage 2 results in mathematics were the highest recorded, with 77 per cent of pupils achieving the expected level, but this was eight percentage points below the target of 85 per cent that had been set for 2006. The Government has set two new targets for 2011 – a combined target for attainment in English and mathematics (78 per cent of pupils achieving the expected level in both subjects) and a target for progress between Key Stages 1 and 2 (in mathematics, 84.5 per cent of pupils progressing by two National Curriculum levels). Modelling by the Department indicates that meeting the targets will be difficult: based on average rates of improvement from 2004 to 2007, only 74 per cent of pupils will achieve the target in both subjects, and only 78 per cent will make two levels of progress in mathematics – shortfalls of 4 and 6.5 percentage points respectively. A step change in performance will therefore be needed to meet the targets.

9 A significant minority of pupils of all abilities could make more progress in mathematics during their time at primary school. For pupils who find mathematics relatively difficult, the Department recognises that more needs to be done to provide additional support to help them progress, and from September 2008 is piloting a new programme, *Every Child Counts*, to target this group. More able pupils also need support to make as much progress as they can in the subject. In 2007, there were some 66,000 pupils who did not make the nationally expected level of progress by the end of primary school, even though their earlier attainment suggested that they could.

10 There are persistent gaps between the mathematics performance of primary school pupils from different backgrounds and with different characteristics. We found that:

- The outcomes for both girls and boys are improving with boys doing slightly better than girls at Key Stage 2, in contrast to their performance in other subjects. The differences between boys' and girls' outcomes are more pronounced in respect of the progress made between Key Stages 1 and 2. For girls who achieved the lowest two categories of level 2 at Key Stage 1 (sub-levels 2B and 2C), the differences in their progress compared with boys have more than doubled over the last three years to four and eight percentage points respectively.
- There is considerable variation at both Key Stages according to ethnicity. Pupils from Chinese and Indian ethnic groups do consistently better than white pupils. Pupils from Black African, Black Caribbean, Pakistani and Bangladeshi ethnic groups do significantly less well, though the gap has narrowed in recent years.
- There is a very large gap in attainment between pupils from disadvantaged backgrounds and their peers. At Key Stage 2 the difference is currently 20 percentage points, with only a small narrowing of the gap over the past three years.

School and local authority performance in primary mathematics

11 Attainment has improved in the last five years. We found that:

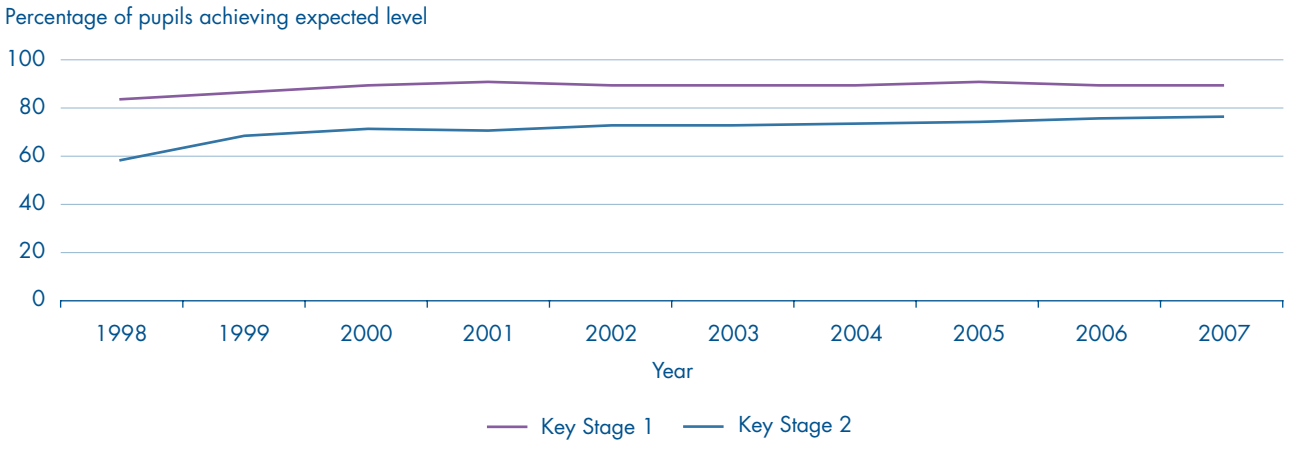
- In 2007 nearly 85 per cent of primary schools achieved the Department's target for the proportion of pupils reaching the expected standard at Key Stage 2, up from 73 per cent in 2003. Over the same period, the rate of improvement in the percentage of pupils reaching the expected standard was faster in schools with the highest proportion of pupils taking free school meals than in those with the lowest. However, some three per cent of schools have not met the Department's target for the past four years or more.
- Most local authorities have achieved year-on-year improvements, although there is considerable variation in the attainment in mathematics at Key Stage 2. In 2007 the percentage of pupils achieving the expected level at Key Stage 2 mathematics ranged from 66 per cent in some local authorities to 84 per cent in others, and there was a link with relative levels of deprivation.

The impact of improvement programmes on primary mathematics

12 The Primary National Strategy has contributed to improvements in primary mathematics teaching and learning but weaknesses persist. The Strategy's resources and professional development programmes for

2 Percentage of pupils reaching the expected level in mathematics at Key Stage 1 and Key Stage 2, 1998-2007

After significant early increases, improvements in attainment in primary mathematics have slowed in recent years.



Source: Statistical First Releases 1998–2007

NOTE

Provisional national attainment data for 2008 for Key Stages 1 and 2 was released in August 2008. The data showed that for Key Stage 1, mathematics attainment at level 2 or above remained at 90 per cent. At Key Stage 2, mathematics attainment at level 4 or above increased by 1 percentage point from 2007, to 78 per cent. As a result of problems that arose in the delivery of the 2008 Key Stage 2 and Key Stage 3 tests (paragraph 1.8) and the consequent unavailability of pupil-level data, our analyses in the remainder of this report use data up to 2007 only.

teachers have led to more consistency in primary schools' planning and delivery of mathematics teaching, which has contributed to a rise in national performance although weaknesses persist. In particular, using and applying mathematics is often under-emphasised in schools. To help address these concerns, a revised primary mathematics framework was introduced in September 2007, but it is too early to assess how far the new framework will lead to future significant improvements in primary school pupils' achievement in mathematics.

13 Quality of teaching is a key determinant in improving pupils' performance in mathematics. The review by Sir Peter Williams (paragraph 2) identified the need for primary teachers to gain a better knowledge of mathematics. The Government has accepted the review's recommendations in full, including that every primary school should have access to a mathematics specialist within ten years. Other recommendations focus on the continuing professional development of teachers and those who support them.

14 Assessment of pupils' progress is one of the weakest aspects of teaching mathematics in primary schools. Ofsted and other experts have consistently reported that, in mathematics, teachers' continuous assessment of pupils as they learn is weak, with focus on written work that is easy to assess, rather than on skills such as using and applying mathematics and pupils' understanding of concepts such as number. In May 2008 the Department allocated some £50 million to primary and secondary schools annually until 2011 to support improvements in pupil assessment. In 2008-09, £30 million of this amount is allocated to primary schools.

15 The Department has well-established systems for working with its contractor to deliver the Primary National Strategy. With its main contractor, Capita Strategic Children's Services (Capita), the Department has established a systematic process for the planning and implementation of the National Strategy, including the primary mathematics programme. Capita's contract runs from 2005 to 2010 at a cost of £80 million a year.

16 The Primary National Strategy's website is the major source of advice but its complexity is hindering its effectiveness. Most of the teachers and mathematics experts we consulted considered the website to be a valuable tool, but all found it complex and not user-friendly. Part of the difficulty is the amount of material on the website, much of it useful, but some of which could be removed. The Department is planning more work to make the website easier to navigate.

17 Changes in local authority staffing over the last decade have led to a decline in the number of senior staff available to lead improvements in the teaching of mathematics. Much of the training provided by local authorities to schools now concentrates on whole-school improvement and the practical application of the revised mathematics framework and the Primary National Strategy, rather than improving teachers' knowledge of mathematics. Most local authorities target proportionately more training and advice at schools that are performing poorly or have relatively high numbers of low attaining pupils than at middle-performing schools where gains could also be made.

Value for money conclusion

18 Since 1999-2000, there has been a real terms increase of over 30 per cent in expenditure on primary schools (excluding capital spending). Within the current total of around £10 billion for primary teaching and teaching support staff, we estimate that primary schools spend some £2.3 billion on teaching mathematics. In addition, the cost of implementing the Department's comprehensive Strategy for improving the achievement of primary school pupils in mathematics and literacy in 2007-08 totalled £207 million.

By bringing greater structure and consistency to the way primary mathematics is planned and taught, the Strategy initially helped to improve test results at Key Stage 2 when children finish their primary education. Our analysis also shows that support targeted at the lower performing primary schools, often located in the more disadvantaged areas, has had an impact on mathematics performance.

Since 2000 mathematics attainment at Key Stage 1 has, however, levelled off, with continuing small increases in most years at Key Stage 2. It is too early to tell whether the 2007 revisions to the Department's Strategy will deliver the step change required if targets that have been set for 2011 are to be achieved.

Reasons for the slowing trend include the relatively greater difficulty in improving the mathematics skills of the remaining pupils, for some of whom the barriers to improvement are likely to be high. There are, however, some groups of pupils who could, with help and within existing resources, further improve their mathematics skills at primary level. Aspects of the teaching of mathematics, such as pupil assessment and the deployment of support tools and training for teachers, could also be considerably improved.

Our recommendations

19 As the body responsible and accountable at the national level for the education of primary school pupils, the following recommendations are directed primarily at the Department. All will, however, require responses by local authorities and schools, as the bodies in the lead locally on improving the performance of primary pupils in mathematics, and their roles and responsibilities are emphasised as necessary throughout this report.

a **The Department's target that measures the number of pupils progressing through two or more National Curriculum levels is a useful indicator, both nationally and at school level. It would be possible to further increase the utility of the indicator by more routine analysis of progress between sub-levels of attainment, which would identify those schools whose pupils could be making much more progress, including from a position of relatively high attainment.**

The Department should identify and consult with local authorities that are particularly effective at challenging performance in the schools where pupils are making the least progress. Building on the recent work to improve the assessment of pupil progress, it should issue guidance on how more sophisticated use of data would enable local authorities and schools to agree more stretching targets for increasing rates of progress in mathematics.

b **Girls' progression in mathematics between Key Stage 1 and Key Stage 2 is lower than for boys and the gap is especially marked for girls starting from a lower level in mathematics at age 7.**

The Department should identify what teaching approaches and resources are used for the teaching of mathematics skills to girls who find the subject relatively difficult and why these approaches and/or resources may be hindering their progress. Through the Primary National Strategy's website, the Department should promote and disseminate guidance on what works well in helping girls to make progress.

c **The Primary National Strategy's website is a valuable resource, but teachers have found it large and complex. While work is being done to make it more user-friendly, teachers need more personalised assistance if they are to use it for the maximum benefit of their pupils.**

When reviewing the updated website's content and usability, the Department should use the management information obtained from user feedback to identify strengths and weaknesses to help inform further improvements. As part of his or her continuing professional development, the school's mathematics coordinator should develop a sound understanding of the primary mathematics framework and its resources, and should actively assist other teachers to make the best use of them.

d **Teachers need more subject-based training in mathematics aimed at directly enhancing their practice in the classroom and their use of formative assessment to track pupils' achievement and help them to progress.**

The Department and local authorities should facilitate better collaboration between schools so that best practice is shared. High performing schools could be encouraged to release their leading mathematics teachers for a proportion of their time to other local schools that are performing less well: for example, by allocating some school improvement funding to schools to cover costs and provide incentives to collaborate; by promoting the development benefits of cross-teacher exchanges and peer review; and by secondary teachers teaching year 6 classes, as well as observing the teaching methods used by primary teachers, in the run up to the secondary school transfer.

e **The Department's Strategy has achieved a more consistent approach across schools in the teaching and assessment of mathematics, but there is a further need to increase pupils' enjoyment of the subject. Both are necessary for pupils to remain motivated and do their best in mathematics.**

Supported by the relevant national advisory agencies, including the National Centre for Excellence in the Teaching of Mathematics and BECTA, the Department should better signpost schools to the Information Communication Technology applications and other resources that are proven to engage pupils most effectively in meaningful mathematics learning. It should provide clear continuing professional development guidance on how to make best use of these resources in the classroom, and draw on good practice overseas from countries that perform strongly in primary mathematics, such as the Netherlands and Latvia.