Children who attain level 4 in English but not mathematics at Key Stage 2

For the purpose of this report, children who attain level 4 or above in English but not mathematics will be referred to as *the target group*.

Summary of report findings

Introduction and context

This report arose out of a national concern about the large number of pupils who, at the end of Key Stage 2, currently attain level 4 or above in English but not in mathematics. The project involved collecting evidence and analysing data from a sample group of just under 200 schools in order to identify underlying factors that contribute to, and influence, the mathematical underachievement of this target group of pupils. It also involved collecting and analysing pupil-level data from a focus group of 17 schools. A key aim of this research has been to identify actions that schools might take towards raising the mathematical attainment of pupils who, without targeted support, look likely to attain level 4 in English but not mathematics by the end of Year 6. The information and suggestions set out in this report are intended to provide a valuable addition to the tools that headteachers, mathematics subject leaders and teachers already use in their ongoing drive to raise attainment in mathematics.

The process used for this exercise is one that local authorities may adopt with groups of their schools. This research model provides a vehicle for engaging in close collaboration with a focus group of schools as part of a local authority's ongoing schools support and improvement programme. Appendix A contains a flow chart summarising the model used in this project that may be useful for this purpose. The feedback to the focus group of schools will be followed up later in the year to determine how the leadership in the school has implemented the recommendations and actions in their report and to begin to determine the impact these have had on the target group of pupils.

Key factors affecting attainment in mathematics, and recommendations

The factors identified in this report that appear to affect the proportion of pupils who attain level 4 in English but not mathematics by the end of Key Stage 2 are identified below.

Uneven progress in mathematics through Key Stage 2

Over half of the target-group pupils in the focus schools attained the 'benchmark' level of 2b or above in mathematics at the end of Key Stage 1, but did not go on to attain level 4 by the end of Key Stage 2. Progress for the target-group pupils (measured using average annual increases in point score) was markedly lower in Years 3 and 4 than in upper Key Stage 2. In fact the progress the pupils made over Key stage 2 fell well below the two levels expected, and while there was greatest progress made in Year 6, this was not enough to compensate for the poor progress made over Years 3 and 4.

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Recommendations:

- Schools need to ensure that their system to track pupils' progress in mathematics is sufficiently robust in order to identify pupils whose lack of progress is a cause for concern.
- Schools should make use of the Assessing Pupils' Progress (APP) process as a tool to review the progress of vulnerable pupils and identify more precisely the barriers to their attainment and progress in mathematics.
- Schools should put early intervention strategies in place as soon as a child's lack of progress in mathematics is identified. In particular, this should involve the class teacher in planning and providing regular, focused guided group work sessions as part of daily mathematics lessons. These sessions should draw on assessment information to target the group's shared learning barriers within the daily mathematics lessons, addressing particular gaps in learning or key areas of difficulty that inhibit progress. Schools may organise intervention sessions in addition to the daily mathematics lesson, but these must relate to the day-to-day learning in the daily mathematics lessons to maximise impact.
- Mathematics subject leaders should play a key role in helping teachers to analyse assessment information and to plan guided group work sessions. There are a number of available publications to draw on that are designed to target planning and teaching to the needs of the children within the daily mathematics lesson and within intervention sessions. These are listed at the end of this summary.

Differences in the attainment of girls and boys

A high proportion of the target-group pupils in the focus schools were girls. In addition, individual feedback given to many of the focus schools noted that a disproportionately small group of girls had attained level 5 when compared to boys. The gender gap in mathematics identified in nearly all schools had not been noted and was not being addressed by the school. Only one headteacher had plans in place to close this gap. The progression agenda and new public service agreement (PSA) targets focus attention on the need to close any gap in rates of progress. However, the evidence from this project shows that there are key messages about the under-attainment of girls that we need to share with schools, and recommended actions that schools can take to accelerate the progress and raise the attainment of girls.

Recommendations:

- Schools should analyse the attainment of each cohort in the school by gender in order to identify whether there are any imbalances in the attainment of boys and girls that need to be addressed over the course of the key stage.
- Teachers should engage girls in targeted Assessment for Learning activities, to help them to understand and recognise the progress they are making and the next steps in learning they need to take to continue to progress.
- Schools should review girls' confidence in their ability to do mathematics, and where appropriate: promote a 'can do' approach to problem solving and enquiry within a self-supporting group who are expected to help one another and share their thinking;

encourage these girls to discuss and share mathematical ideas, processes and strategies, and from time to time to present to the rest of the class.

- Teachers should set high expectations for girls' learning and attainment, pitched at a level that ensures they are on track to meet age-related targets for mathematics as set out in the Primary Framework.
- Schools should make effective use of the prior learning sections, assessment questions and learning overviews in the Primary Framework to plan assessment opportunities for identified groups of girls making slow progress or those 'hidden' girls about whom there is little assessment evidence available.
- Teachers should engage girls who make slow progress, or fall behind in their learning, in guided group work sessions that focus on mental mathematics and discussion, with mathematical activity that involves girls in decision-making, explaining and reasoning.
- Schools should monitor the balance and range of girls' learning experiences and where necessary provide supportive hands-on learning using practical resources and models and images in mathematics, including the visualising of models such as number lines that can provide support strategies for calculation.
- Teachers should encourage girls to take risks and move away from the safety of routines; engage girls in answering more open-ended questions, sustaining a line of enquiry and using ICT as a platform to explore and access information they can use to hypothesise, test and review ideas.
- In the daily mathematics lesson, teachers should give girls sufficient opportunity to answer questions during a class or group discussion, provide sufficient time for them to answer, and where necessary, give boys other tasks to complete to ensure they do not dominate these sessions.
- Teachers should provide girls with structured and scaffolded activities where they can use and apply their mathematics learning; over time remove the scaffolding so they come to rely less on the applications of routines and more on interpretation, pattern spotting, and the making and testing of conjectures and generalisations.
- Teachers should model for girls how to use personal jottings and make annotations in mathematics to demonstrate how these can help thinking, and promote their use alongside or in place of the neat presentations girls often see as the end product of a mathematical activity.
- Schools should make mathematics interesting to girls and help them become more aware of the importance of mathematical knowledge and skills in the workplace, drawing on the evidence that poor numeracy is a greater barrier to women finding work than it is for men.

The proportion of special educational needs (SEN) pupils in the cohort

Overall there was a positive correlation between the number of pupils in a cohort who were identified as having special educational needs and the proportion of pupils in the cohort who attained level 4 or above in English but not mathematics. The focus of the support for these children tended to be on improving English skills and behaviour management. Rarely was

the support specific to the mathematical needs of the child. In some schools, literacy difficulties may be more readily identified than mathematical difficulties.

Recommendations:

- Schools should identify the extent to which the pupil's specific learning difficulties affect their mathematical learning and determine whether this impact is greater or lesser than it is on their learning in English.
- Schools should review whether the pupil's individual education plan (IEP) targets, and the majority of support and intervention, are focused on literacy even if the child is more likely to attain level 4 in English than in mathematics.
- Schools should look at how the pupil's specific difficulties in literacy may impact on their mathematical understanding and development, and determine how these specific difficulties in literacy may best be supported in the pupil's learning of mathematics.
- Schools should review how effectively difficulties in mathematics are identified, recognised and catered for within their current special needs provision.

Level 5 attainment in mathematics

It was generally the case that where the proportion of pupils who attained level 4 in English but not in mathematics was significant, the proportion of pupils attaining level 5 in mathematics was low. Put another way, schools that had a low percentage of pupils attaining level 5 in mathematics also tended to have a relatively high proportion of pupils who attained level 4 in English but not mathematics. For these schools the challenge lies in raising standards of mathematics across the board. A significant factor here tended to be the rate of progress pupils made in mathematics over Key Stage 2.

Recommendations:

- Local authorities should target schools where level 5 attainment in mathematics falls well below expectations, using this as a proxy indicator of underachievement at level 4, and should analyse each school's attainment data to identify the scale of underachievement in mathematics.
- Senior leadership teams in schools with well below average level 5 attainment in mathematics should use the Primary Framework to review the expectations and standards of mathematics teaching and learning for all pupils and analyse the progress made by those pupils whose attainment in mathematics at the end of Key Stage 1 was at level 2a or level 3.
- Mathematics subject leaders should help teachers to use the resources 'Securing level 3 in mathematics', 'Securing level 4 in mathematics' and 'Securing level 5 in mathematics' (in development at the time of writing) to ensure that expectations are appropriately high for all children, to inform planning and assessment within daily mathematics lessons and to provide target groups of pupils with effective intervention and support.
- Teachers should use assessment data to identify pupils making slow or no progress in mathematics and to inform the grouping of pupils with common mathematical barriers to learning, drawing on the identified list of areas of mathematics in the

Overcoming barriers in mathematics materials and the key areas of mathematics identified below.

Key areas of mathematics that pupils who attained level 4 in English but not mathematics found particularly challenging when compared to pupils who attained level 4

The analysis of question-level data identified a number of common areas of mathematics that the pupils who were close to attaining level 4 found particularly challenging. Those pupils who attained a low or secure level 4 had the knowledge, skills and understanding needed to answer the questions correctly. There were clear patterns emerging from the analysis that showed how fragile the mathematical confidence was of the pupils working just below level 4. The level 4 pupils were more secure in most areas of mathematics identified below and more willing to 'have a go' at a question. However, many of the level 4 pupils also had difficulty answering questions that related to problem solving and reasoning.

It was evident that the skills many of the pupils had acquired in literacy that involved careful reading and interpretation of questions and the recording of their methods, explanations and reasons did not appear to be applied to the contexts of mathematics presented in the test questions. Focusing intervention support or strengthening the emphasis in planning on the areas of mathematics identified above could significantly raise the mathematical attainment of pupils who otherwise might not attain level 4 in mathematics.

Problem solving, communication and reasoning:

- Solving multi-step problems, particularly those involving money and time
- Reasoning about numbers, including the identification and use of the inverse operation to undo a process
- Thinking through the steps in a question in a logical sequence and representing this to show their workings or to explain their method

Number and the number system:

- Completing a sequence involving three-digit numbers
- Recognising equivalence of fractions and decimals
- Recognising and finding simple fractions of shapes and numbers
- Solving problems involving multiples and factors of numbers
- Questions involving comparisons of two-digit and three-digit numbers and understanding relative values

Calculation:

- Multi-step problems involving multiplication and division of two-digit and three-digit numbers
- Responding at speed to mental calculation involving subtraction of two-digit numbers and calculations involving multiples of 10 in all four operations

- Choosing and working out the calculations needed to solve money problems including those involving change
- Calculating time differences
- Calculations involving decimals

Handling data and measures:

- Accurate reading of scales that had non-unit intervals when identifying values as a measure of quantity and when identifying values on a graph or chart
- Choosing and working out the appropriate calculations needed to answer a question using data read from a table, graph or chart
- Labelling appropriately a scale on a graph or chart, or the groups in a Carroll diagram

Recommendations to schools

As part of this research, the focus schools received detailed individual feedback based on the question-level analysis of their Year 6 pupils. While the detail in the feedback varied from school to school to reflect the mathematical barriers of their particular pupils, there were many common themes. The recommendations below applied to a very high proportion of the schools and in many cases to all the schools involved.

Raise standards in number and calculation

- Ensure that for all pupils expectations are set at a high enough level in calculation. Use the Primary Framework to establish clear progression in calculation throughout the school at a pace that reflects age-related and national expectations, around which more personalised learning can be planned for particular groups of pupils.
- Provide all pupils with regular and frequent oral and mental calculation activity that is designed to develop speed and the use of a wide and secure range of mental calculation strategies alongside the skills pupils need to calculate using written methods when working with two-digit and three-digit (and then larger) numbers.
- Demonstrate with pupils models and images, such as a number line that pupils can use to help them to compare and order numbers, and practical resources such as place value cards or number grids that demonstrate the constituent parts of numbers and support concepts around place value, partitioning and the recognition of the relative value of numbers.
- Keep a focus on strengthening pupils' calculation involving all four operations, and provide contexts for the calculations using the language and vocabulary the pupils need to interpret to identify the operations to use when solving problems.
- Introduce fractions to pupils as numbers that lie between whole numbers; as a way of describing a proportion or part of an object or shape; as a way of representing a division and the remainder after a division; and as an operator when finding a fraction of a quantity. Make the distinctions to help pupils to recognise how they are to interpret and use a fraction. For example, when finding fractions of shapes, build an image of the fraction holding the information that explains the number of parts that make up the whole object and the parts required to be found.

Developing skills in handling data and measures

- Ensure that pupils measure quantities using practical apparatus where the scales used require taking a reading against a non-unit interval and having to interpret the size of an interval and approximate where necessary. Relate the practical activity to scales represented on diagrams, graphs and charts and with pupils look at different ways an interval might be interpreted when the start and end numbers are changed.
- Provide pupils with graphs and charts that have scales with non-unit, unnumbered intervals. Ensure that the pupils can label and annotate the scales on these diagrams. For example, give pupils graphs and charts with the scale removed and invite the pupils to add a scale that other pupils then use to read results.
- Have pupils explore tables, graphs and charts of different kinds that are available electronically and in newspapers and other publications. Model for them how they can extract data to answer questions that involve calculations with all four operations. Highlight how the language in the questions draws attention to which particular operations to use. Involve the pupils in posing questions using language that promotes their interpretation skills and mental calculation strategies.

Increase pupils' confidence and skills in problem solving and reasoning

- Ensure that pupils have sufficient opportunities to apply and develop their problem-solving skills. Draw on the examples from the Primary Framework where the use and application of mathematics is intended to be integral to every two-week and three-week unit. Subject leaders should discuss with teachers how to plan problem-solving opportunities and to teach pupils the skills and strategies they need to solve problems and express their methods and decisions.
- Provide some opportunity for pupils to use and apply their mathematics in each daily mathematics lesson through short, focused, contextualised questions or explanation and reasons for an observation about a shape or set of numbers, or by undertaking a sustained enquiry over a period of lessons.
- Integrate guided group work into daily mathematics lessons with a focus on developing problem-solving skills such as identifying operations in multi-step problems and then recording steps towards solving them. In this way, teachers and teaching assistants can work regularly with small groups to scaffold and model approaches to problem solving.
- Include regular examples where solving problems involves the accurate reading of data from tables, graphs and charts and the use of information retrieved to calculate as part of the problem- solving task.

Use support materials to adapt planning in order to address key areas of weakness

- Make use of the *Overcoming barriers in mathematics* materials. Focus particularly on areas identified in analysis and ongoing assessment. The materials can be used to support general planning and differentiation but will be particularly valuable in planning targeted guided group activities. Assessment examples are included to help

review pupil progress. The Teaching Guidance sections contain useful information to guide the support provided by teaching assistants.

- Make use of the *Securing level 3 in mathematics* and the *Securing level 4 in mathematics* materials. Focus particularly on areas identified through the analysis and ongoing assessment. These materials are likely to be particularly useful in supporting general planning and differentiation.
- The two resources above provide focused support in addressing key areas of weakness such as reading scales, solving problems involving money and time, and understanding fractions and decimals. They could be used to plan in-class intervention and support. Where schools do not run specific additional intervention teaching, they could be used to plan targeted guided group work sessions within the daily mathematics lesson.
- Make use of the Assessing Pupils' Progress (APP) process with a particular focus on one attainment target to help secure appropriate expectations and to identify where there might be barriers to progress. Pupils looking likely to attain level 4 in English but not mathematics should be targeted for closer tracking purposes, with assessments informed by the use of the APP process.

Useful resources for schools

Overcoming barriers in mathematics – helping children move from level 3 to level 4 DCSF 00695-2007

Overcoming barriers in mathematics – helping children move from level 2 to level 3 DCSF 00149-2008

Overcoming barriers in mathematics – helping children move from level 1 to level 2 DCSF 00021-2009

These materials are designed to help teachers ensure that children in Key Stage 2 progress to level 3 by the end of Year 4 and to level 4 by the end of Year 6.

Increasing numbers of children are achieving higher levels in mathematics, but some children still meet barriers in their learning that slow or block their progress. The materials in the booklet and on the CDs provide teaching resources and ideas for teachers to use when planning additional support for those children. Note: the level 1 to 2 materials will be available from early March 2009. Later in the year, guidance for teachers and teaching assistants will become available on how these materials might best be used to help children progress.

Securing level 2 in mathematics

Securing level 3 in mathematics

Securing level 4 in mathematics

Securing level 5 in mathematics

These four booklets will be available over the course of the year. The first to be published is *Securing level 4 in mathematics*, which will be available from early March 2009. They all

provide guidance on securing key areas of mathematics learning. They are designed to help teachers ensure that pupils make good progress in mathematics across each key stage.

Supporting children with gaps in their mathematical understanding
DCSF 1168-2005G

These Wave 3 mathematics materials aim to enable children who are working at levels significantly below age-related expectations to secure the mathematical understanding they need to increase their rate of progress. The materials provide a series of short, focused teaching activities that tackle fundamental errors and misconceptions that may be holding them back.

Assessing Pupils' Progress (APP)

APP is a structured approach to periodically assessing mathematics and reading and writing so teachers can:

- track pupils' progress through Key Stages 1 and 2
- use diagnostic information about pupils' strengths and weaknesses.

Details and associated resources can be found at:
http://www.standards.dcsf.gov.uk/nationalstrategies/app

Developing language and reasoning through guided group work in mathematics

This continuing professional development (CPD) theme is aimed specifically at schools that wish to consider enhancing children's language and reasoning in mathematics through the use of guided group work in mathematics, using collaborative CPD to reflect upon and develop approaches to teaching and learning.

Details of how to obtain or download all of these resources can be found at the following URL by searching for the title or reference number:
http://www.standards.dcsf.gov.uk/nationalstrategies

Full report

Introduction and context

This research was prompted by concern at national, local authority and school level about the large number of children who currently leave primary school having attained level 4 or above in English but not mathematics. This concern is based on a view that, for many pupils, the ability to attain level 4+ in English would indicate the potential to attain level 4 in mathematics. Clearly, the issue is more complex than this: English and mathematics are quite different subjects requiring a different, though overlapping, set of skills and a different knowledge base. It is therefore likely that some children will have more natural talent in one subject than the other, or may have specific difficulties in one subject but not the other. However, it is important to research this area in more detail as there are likely to be a considerable number of pupils who, with targeted support, would be able to raise their attainment in mathematics to match their attainment in English. For the purpose of this report, children who attain level 4 or above in English but not mathematics will be referred to as the target group.

For this project, research was carried out at two levels: using school-level data from a large group of schools, and using pupil-level data from a smaller focus group of schools.

Using school-level data from a large group of schools

The distribution of target-group pupils in the 2008 Year 6 cohort of a sample group of just under 200 schools was analysed alongside other school statistics to answer questions such as:

- What is the general distribution of children attaining level 4 in English but not mathematics when compared to children attaining level 4 in mathematics but not English?
- Does the percentage of target-group children have any correlation with the size of the cohort?
- Does the percentage of target-group children have any correlation with the proportion of children with SEN in the cohort?
- Does the percentage of target-group children in a school have any correlation with the percentage of children attaining level 5 in mathematics?

Answers to such questions are intended to help local authorities to identify schools for particular support and to indicate the actions schools could take towards raising the mathematical attainment of target-group pupils.

Using pupil-level data from a smaller focus group of schools

Individual pupil data was gathered for pupils in 17 focus-group schools. Through interrogating the data collected, the project aimed to answer questions such as:

- Are there key areas of mathematics in which the target group appeared to be particularly weak and had difficultly in answering in the statutory test?

- What is the gender balance within the target group compared to the gender balance of the entire cohort?
- What proportion of target-group pupils are recognised as having special educational needs?
- To what extent did this group of children receive intervention teaching in mathematics and/or English?
- Were Key Stage 1 results for this group lower than average or did their progress slow or stop at any key points through Key Stage 2?

Through answering such questions, this research identifies key actions that primary schools should consider taking to raise the mathematical attainment of pupils who are otherwise likely to attain level 4 in English but not mathematics by the end of Year 6.

Collection and analysis of pupil-level data from the 17 focus schools prompted reflection and discussion with the headteachers of the schools, not only about the target group of pupils but more generally about mathematics teaching and learning in these schools. As part of the research process, question-level data for each school's Year 6 cohort was analysed in detail and key findings and recommendations shared with the headteacher and subject coordinator. An example of this feedback is included as Appendix C. Schools have used their analysis information in a variety of ways. Some have used it in a staff meeting to promote discussion about how to incorporate recommendations into ongoing practice. Others have used feedback in a senior leadership team meeting to inform their mathematics action plan. The research process has proved to be of value to schools. It has produced research information that sheds light on factors that can be extrapolated to affect the proportion of target-group pupils nationally. In addition to this, it has supported the schools directly involved in the project in reflecting on their strengths and areas for development in the teaching and learning of mathematics. The process adopted for this exercise is therefore one that local authorities may adopt with groups of their schools. This research model provides a vehicle for collaboration with a focus group of schools as part of a local authority's ongoing schools support and improvement programme. Appendix A contains a flow chart summarising the model used in this research that may be useful for this purpose.

Method

The project initially involved analysis of the 2008 Key Stage 2 national test results in English and mathematics for a sample group of 197 schools from one region in England. The group contained a broad mix of schools, including schools in urban and rural settings, and large and small schools. Data was gathered for each school which included the size of the 2008 Year 6 cohort, the number of pupils recognised as having special educational needs, and the percentage of Year 6 pupils attaining level 4 and level 5 in English and mathematics. This data was then analysed to examine the distribution of target pupils within and across the schools and to identify possible links between: the proportion of target-group pupils in each cohort; the cohort size; the proportion of special educational needs pupils; and cohort attainment at level 5.

From this large group, a smaller group of schools was approached to become part of the focus group for individual pupil-level research. In order to collect data on a reasonable size group of target pupils, only schools where 9 per cent or above of the cohort attained level 4

or above in English but not mathematics were included. The focus group consisted of 17 schools. These schools were chosen so that the group included city, town and village schools, and high and low attaining schools.

Question-level pupil data for mathematics was collected for the Year 6 pupils at the focus schools. This was analysed to identify strengths and weaknesses of the Year 6 cohort for each school. In addition, for each school, analysis was carried out to compare the attainment across different test questions for the target group. In particular, there was close scrutiny of the attainment of the group who achieved a low to secure level 4 in mathematics as well as level 4 or above in English. The aim of this was to identify key areas of mathematics where the attainment of the target group was markedly different from the level 4 group and therefore where a stronger teaching or intervention focus might significantly raise the mathematical attainment of the target group of pupils. Outcomes of the analysis for each school together with recommendations were fed back to the headteacher and mathematics subject leader. An example of the feedback shared with a school is included as Appendix C.

Question-level data from all 17 focus schools was used to populate two databases. The first contained the data for the target-group pupils in the 17 schools. Question-level data was available for 121 pupils in this group. The second database contained question-level data for the pupils who attained level 4 and above in English, and in mathematics a low to secure level 4. This group consisted of 104 pupils. For each question in the 2008 Key Stage 2 national test, the difference in attainment between the two groups was found and tested for significance. Questions where the difference between the attainment of the two groups was significant were then ranked and analysis done to identify the common areas of difference.

In addition to question-level data, further background details were collected on the target pupils from each school. Where available, this included: end of year levels in mathematics from Year 2 to Year 5; special needs status; and whether each pupil had received any specific intervention teaching in English and/or mathematics. This information was then analysed to identify common features across the target group of pupils.

Two additional activities were carried out to get a wider perspective than quantitative data alone can provide: headteachers and mathematics subject leaders from the focus schools were asked about some of the issues that, from their experience, they felt might contribute to the proportion of pupils attaining level 4 or above in English but not mathematics; a group of Year 6 pupils whose attainment in English was higher than their attainment in mathematics were interviewed about their experiences and views of learning mathematics and learning English.

Results

Analysis of school-level data (197 schools)

Distribution of target-group pupils

In this sample group of 197 schools, 522 out of 6,134 pupils (8.5%) attained level 4 or above in English but not mathematics. The table below shows the percentage of children who attained level 4 in English but not mathematics, and the percentage of children who attained level 4 in mathematics but not English for each of the 197 schools.

Table 1

Table showing the percentage of children attaining level 4 in mathematics but not English and the percentage of target group pupils in the sample group of 197 schools

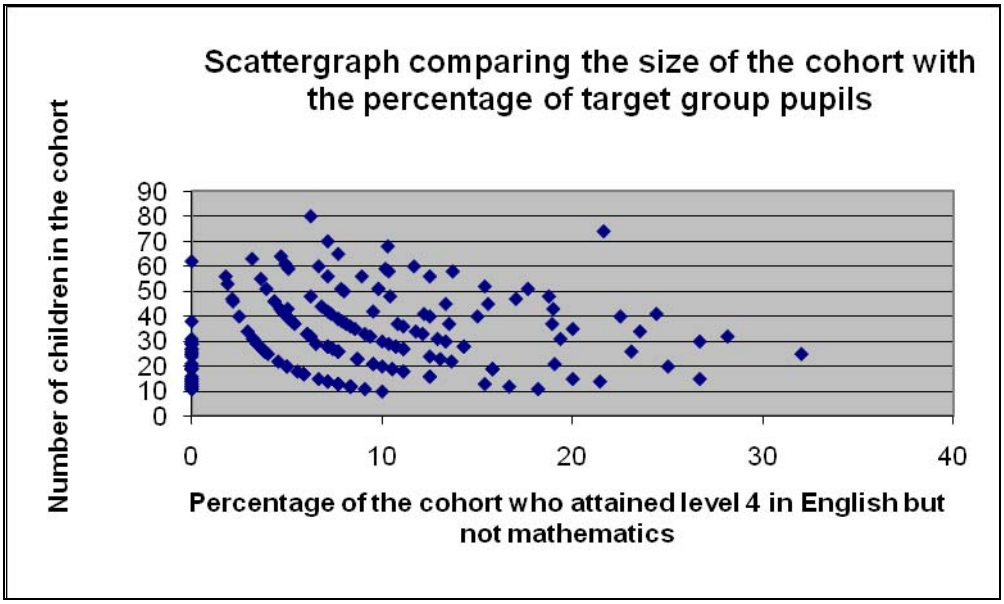
Percentage of children who attained level 4 in mathematics but not English	0 to 4	5 to 9	10 to14	15 to19	20 to 24	25 to 29	30 to 34	
30 to 34	0	0	0	0	0	0	0	36 schools
25 to 29	1	1	1	0	0	0	0	
20 to 24	1	0	0	0	0	0	0	73 schools
15 to19	2	4	0	0	0	0	0	
10 to14	3	7	5	2	1	0	0	88 schools
5 to 9	16	27	17	5	4	2	0	
0 to 4	41	29	13	9	3	2	1	
Percentages have been rounded	0 to 4	5 to 9	10 to14	15 to19	20 to 24	25 to 29	30 to 34	

Percentage of children who attained level 4 in English but not mathematics

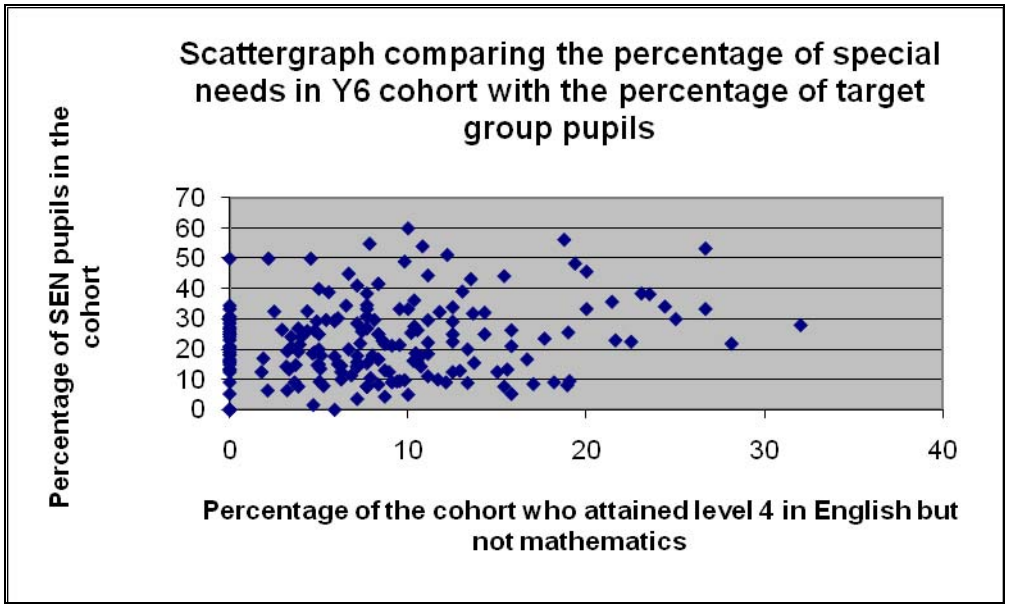
Table 1 shows that more schools in the sample group have a higher percentage of pupils who attained level 4 or above in English but not mathematics than the other way round. This reflects the national picture. Over a third of the schools have similar percentages of pupils in both groups.

Correlation between the proportion of target-group pupils in a school and other factors

Graph 1



Graph 2



Graph 3

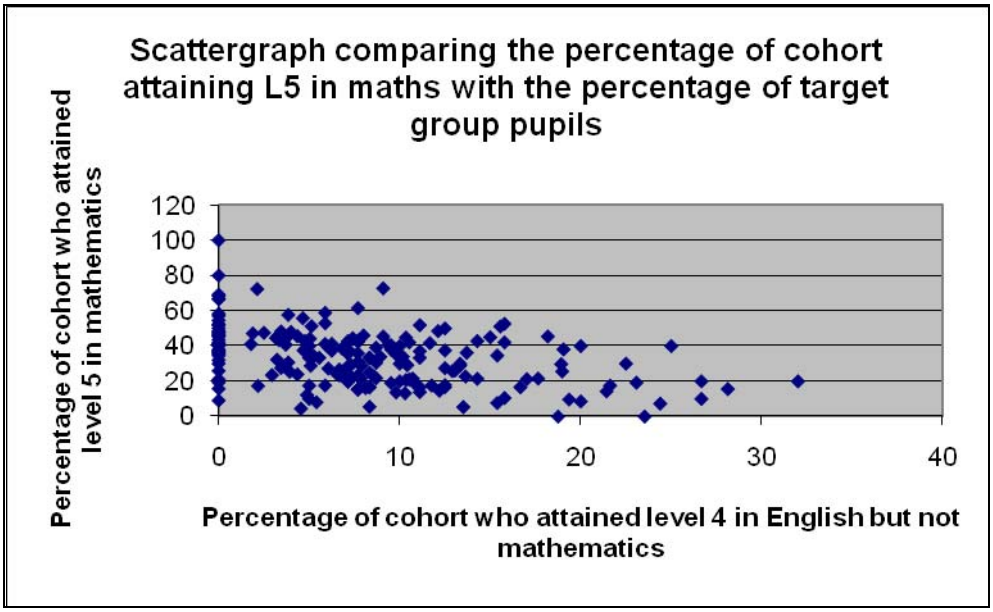


Table 2

Factor	Correlation coefficient
Size of Year 6 cohort	0.09 NS
Percentage of pupils in Year 6 cohort identified as having special educational needs	0.24 *
Percentage of pupils in Year 6 cohort who attained level 5	-0.43 ***

*** = p<0.001, ** = p<0.01, * = p<0.05, NS = not significant

There appears to be no evidence to suggest a significant link between the number of pupils in a Year 6 cohort and the proportion of pupils in the target group.

There is evidence of a positive correlation between the percentage of SEN pupils in a cohort and the percentage of target pupils. Thus, cohorts containing a large proportion of SEN pupils appear more likely to contain a large proportion of pupils who attain level 4 in English but not in mathematics. The support that pupils who are identified as having special educational needs receive is often in English and rarely in mathematics. This may go some way in accounting for the correlation.

The data shows that in schools with a high percentage of pupils who attained level 4 or above in English but not mathematics, the percentage of pupils attaining level 5 in mathematics is very likely to be low. These schools appear to be struggling to find strategies to ensure standards in mathematics are high across the board. In other words, the issue is not solely about raising attainment in level 4 but is about raising standards in mathematics more generally.

Analysis of pupil-level data for target-group pupils (17 focus schools)

Progress through Key Stage 2

Where available, mathematics levels from Year 2 to Year 5 were collected for each of the target pupils in all the focus schools. Where a test result was not available, the corresponding Teacher Assessment level was used. Levels were converted to point scores in order to find point score increases over given years. The standard point score approach was used, i.e. level 1a allocated 11 points; level 2c allocated 13 points; level 2b allocated 15 points, and so on.

Table 3

Mean point score increase from Y2 to Y3	1.6
Mean point score increase from Y3 to Y4	1.8
Mean point score increase from Y4 to Y5	2.1
Mean point score increase from Y5 to Y6	2.5
Mean point score increase from Y2 to Y6	8.0

From Table 3, we see that those pupils in the target group, on average, made slower progress in lower Key Stage 2 than they did in upper Key Stage 2, particularly in Year 6. In fact the average gain made across each of Years 3 and 4 fell below 2 points – 2 points represents a gain equivalent of one sub-level – so progress was well below that expected in all four year groups. The overall gain was equivalent to four sublevels, not the two or more levels expected. This means that those pupils who attained level 2b at the end of Key Stage 1 would make an average gain of only four sublevels and not attain level 4. The uneven progress through Key Stage 2 signals an important area for schools to address in order to raise the attainment of this group of pupils – the need to track progress across the key stage and ensure that progress equates to six sublevels or to 12 points using the system above. Several of the focus-group schools in discussion mentioned that they had recently made their system of tracking pupil progress more robust to enable them to identify children whose progress appeared worryingly slow and to put actions in place to support those children.

Table 4

End of KS1 level	Proportion of target group attaining this level
p-levels	3.8%
1c	3.8%
1b	3.8%
1a	3.8%
2c	32.9%
2b	44.3%
2a	7.6%

End of Key Stage 1 Median level = 2b
End of Key Stage 1 Median point score = 15

End of KS2 level	Proportion of target group attaining this level
N	3.3%
3c	14.3%
3b	31.9%
3a	50.5%

End of Key Stage 2 Median level = 3a
End of Key Stage 2 Median point score = 23

Schools have long been aware that children who attain level 2c at the end of Key Stage 1 are likely to need focused support in order to attain level 4 by the end of Key Stage 2. From the data above, it is evident that over 50 per cent of the target-group pupils had obtained a level 2b or above in mathematics at the end of Key Stage 1, yet had still not reached level 4 by the end of Year 6.

Special educational needs

Altogether 29 per cent of the pupils from the 17 focus schools were identified with special educational needs, while 40 per cent of the target group of pupils were identified with special educational needs. These are pupils who attained level 4+ in English but not mathematics. This result is not surprising, as the support is much more likely to address learning needs in English than in mathematics.

Intervention

The overall picture about how much intervention teaching pupils in the target group received was hard to quantify. Different schools organised targeted teaching and intervention in very different ways. About half, 9 out of 17 schools, did provide some mathematics intervention teaching in addition to daily mathematics lessons. Others deployed teaching assistants within the daily mathematics lesson to support target pupils.

Setting for mathematics

About a third of the schools in the focus group organised their teaching groups for mathematics into sets by ability. This project did not have the scope to investigate the impact of setting on attainment. However, the data did raise some issues that would be worth pursuing. The school in the focus group, where the difference between question-level attainment for the target group and the level 4 group was starkest, was a school that did set. The schools which set for mathematics generally provided less additional intervention teaching than schools that taught mathematics in mixed-ability groups. These outcomes suggest that schools could usefully consider the way in which they organise their teaching of mathematics to ensure that the progress of all pupils, including target-group pupils, is maximised.

Gender

In the 17 focus schools, 47 per cent of pupils in the 2008 Year 6 cohort were girls. However, in the target group 66 per cent of the pupils were girls. Thus, a significantly higher proportion

of girls than would be expected attained level 4 in English but not mathematics in this group of schools.

Individual feedback given to many of the focus schools, based on analysis of their entire Year 6 cohort, noted a marked difference in the attainment of boys and girls at level 5, with the percentage of boys attaining level 5 being considerably higher than the percentage of girls. These two pieces of evidence suggest that in a number of the focus-group schools, girls were underperforming at level 5 and at level 4. However, headteachers' awareness of this as an issue in their school was poor and there was very little activity in place to address the under-attainment of girls.

In initial discussion at the start of the project, only one headteacher from the group of focus schools commented that they had already identified that there was a gender bias in the mathematics attainment of their Year 6 cohort. This school had also identified that this bias was not specific to this cohort but was more widespread, and so had started to put strategies into place to address the issue, including planning some group activities into mathematics lessons where girls were grouped together in order to maximise their involvement in the activities.

National data

Over the four years from 2004 to 2007, the rates of progress over Key Stage 2 that have been made by boys and girls show that an increasing gap has emerged.

Table 5

KS1 Level 2c to KS2 Level 4				
Year	2004	2005	2006	2007
Boys	**47.8**	**45.3**	**47.6**	**52.9**
Girls	**43.7**	**40.8**	**40.7**	**44.4**
Difference	4.1	4.5	6.9	8.4

KS1 Level 2b to KS2 Level 4				
Year	2004	2005	2006	2007
Boys	**76.8**	**76.9**	**76.7**	**81.7**
Girls	**74.8**	**75.0**	**73.0**	**77.1**
Difference	2.0	1.9	3.7	4.6

KS1 Level 3 to KS2 Level 5				
Year	2004	2005	2006	2007
Boys	**76.3**	**75.2**	**76.2**	**77.6**
Girls	**70.7**	**70.5**	**70.9**	**72.2**
Difference	5.7	4.7	5.3	5.4

The tables show that the conversion rates for boys and girls who attained level 2c or level 2b in mathematics at the end of Key Stage 1 were at their highest in 2007. However, conversion still remains too low and must increase significantly if the PSA targets for 2011 are to be met. Furthermore, the gap between boys and girls has more than doubled over the last four years. What is particularly worrying is that those pupils who are assessed at the end of Key Stage 1 as attaining level 2b, (a secure level 2) do not all progress to level 4 or above by the

end of Key Stage 2; in the case of girls nearly one quarter do not do so. It signals that expectations of these pupils are too low.

In 2007, the rate of progress made by boys and girls who attained level 3 at the end of Key Stage 1 was also higher than it has ever been. However, there are still a quarter of the pupils who do well at the end of Key Stage 1, who do not make two levels of progress and attain level 5. Pupils who attain level 3 at the end of Key Stage 1 are the most able pupils and should progress to level 5 with relative ease. That a quarter only progress one level signals insufficient challenge and a narrow and uninspiring curriculum in mathematics that does not enhance their learning or engage them sufficiently in the subject.

Closing the gap – the challenge

National focus on boys' underachievement in literacy

- The attention that has been given to raising standards in boys' writing has been translated into a general assumption that it is boys who are underachieving and who need attention and support. As attention has been given to boys' underachievement, their rate of improvement has grown; however, the attainment of girls has not kept pace with that of boys. This focus has taken attention away from the increase in relative mathematical underperformance of girls over Key Stage 2. The improvements made in boys' literacy may provide models we can apply to increasing girls' rates of progress in mathematics.
- The assessment data for English is separated into reading and writing figures, so the underachievement of boys in writing as opposed to reading is very evident. In mathematics, data is less well differentiated and the aggregated data for level 4+ when looked at by gender masks the underlying gaps in the progress made by girls and boys.
- While attention has been put on addressing the low attainment of nationally identified and prioritised groups of underachieving pupils, in mathematics the gender gap has not been given the same priority as has boys' writing.

Lower expectations of girls than boys

- The attention given to attainment at the end of Key Stage 2, rather than on the progress made over the key stage, has led to a focus on underachieving groups rather than on targeting children who make slow progress. Girls whose work is neat and tidy appear to be achieving and progressing, consequently they are not set higher expectations that they should and can achieve in order to make and accelerate their progress.
- At the end of the Foundation Stage, it is interesting to note that girls outperform boys when assessed against the Problem-solving, Reasoning and Numeracy scales, so the greater gains in attainment made by boys over Key Stage 2 might be attributed to the change in the mathematics curriculum or to the teaching approaches used following a more play-based and self-directed learning approach in the Foundation Stage.
- There is still a cultural and community perception that mathematics is a boys' subject and that boys are more likely to need mathematical skills in their future lives while for girls it is less important. This translates into higher expectations being set for boys.

- There is an increase in providing children with a 'creative curriculum' where skills other than mathematics can be celebrated, and a perception that acquiring these skills is more important for girls than mathematics.

Learning styles and pupils' responses to mathematics

- Boys are happy to scribble and annotate or make jottings as they work. Girls take more pride in the way the work is presented; they believe that what the work looks like is as important a part of the process to arriving at a solution as is their understanding of the strategy underpinning the process.
- Boys are prepared to take risks and are encouraged to do so; girls are not expected to take risks but to take the safer option. Girls are more confident when applying routines they are familiar with and will turn to these rather than explore new ways or alternative strategies.
- Boys are more likely to 'have a go' and offer a response without worrying if they make a mistake or are wrong.

Teaching approaches and grouping of children

- The increasing use of ICT in the classroom, particularly the use of interactive whiteboards, has encouraged passive learning with an increase in teacher talk. This has led to more emphasis on interpreting displayed pictures or words, and less active and practical learning. Boys appear more confident in these circumstances, enjoy using ICT and are eager to participate.
- There has been a decline in the use of practical models and images that provide children with the opportunity for hands-on learning. Girls find it more difficult to visualise models such as number lines that can provide support strategies for calculation and so need more, not fewer, opportunities to build up their understanding of mathematics through use of practical models and images.
- The organisation of children does not take account of the needs of girls; they are not provided with the opportunity to work independently rather than alongside dominant boys or to take a lead role in a group when the learning activity is focused on using and applying mathematics rather than routine practice.
- In paired work it is more common for boys to share ideas and to discuss methods and strategies, while girls will discuss the answer to confirm it is correct.

Confidence, attitudes and behaviours

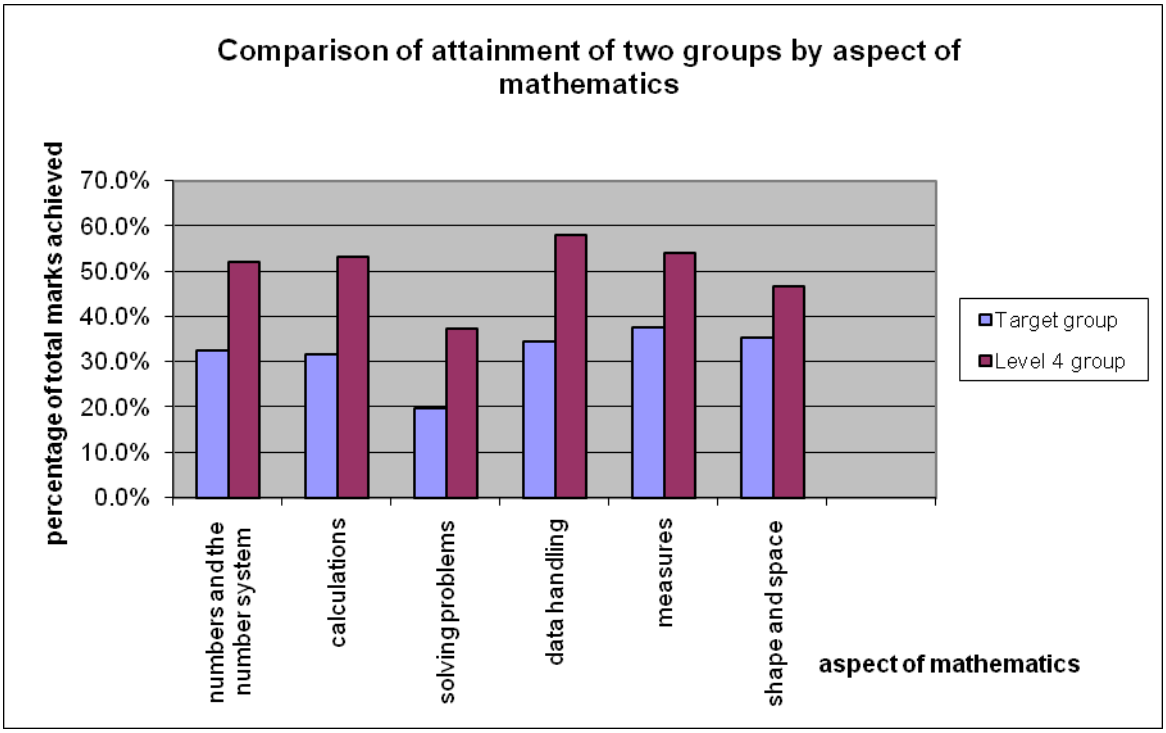
- Boys are more dominant and make their presence known; they appear enthusiastic and put their hands up more frequently and more theatrically to gain the teacher's attention, and are more willing to contribute to discussions and answering questions in the whole-class context.
- Boys are invited to contribute more frequently than quiet and 'hidden' girls, who in the buzz of classroom activity only contribute when asked a direct question or when some direct action is taken to promote a response or engagement.
- The relentless drive to improve boys' behaviour in some schools and classrooms has led to the needs of girls being ignored. Teachers tend to turn to boys first to ensure they are engaged, and use this as part of a behaviour management strategy.

Analysis of question-level data (17 focus schools)

Comparison of attainment across different aspects of mathematics

Question by question, attainment of the target group of pupils from the focus schools (121 pupils) was compared to that of pupils who attained level 4 or above in English and a low to secure level 4 in mathematics (104 pupils), referred to in this section as *the level 4 group*. This was to identify those areas of mathematics that were the most common barriers to pupils making the progress needed to attain level 4. At first the questions were classified into broad categories using the National Curriculum headings in the programmes of study.

Graph 4



The most marked differences in the attainment of the two groups occur in the following aspects of mathematics:

- solving problems
- calculations
- handling data
- number and the number system
- measures.

To gain further detail about specific areas of the mathematics curriculum, individual questions for which the difference between the percentages achieved by the two groups was significant were ranked. This analysis provided a way to get at the finer detail in terms of the areas of mathematics that were key barriers to progress; see Appendix B.

Other information contributing to this research

Views of headteachers, mathematics subject leaders and teachers

At the start of this project, a large proportion of the headteachers and subject leaders in the focus schools identified raising standards in mathematics as a priority in their school and already had measures in place towards addressing this. Many were aware that there were a number of pupils in their 2008 Year 6 cohort who had attained level 4 in English but not mathematics, and were keen to identify ways of supporting children to minimise this situation in future years. Headteachers and teachers suggested that the factors that might affect the attainment of these pupils included:

- low levels of confidence
- specific difficulties with mathematics as a subject
- difficulties in using and applying mathematical knowledge
- behaviour and attention problems
- gaps in learning
- difficulty making links across the mathematics curriculum
- uneven progress over Key Stage 2.

Beyond the identification of the broad area of using and applying mathematics it was noticeable that headteachers did not have the information that enabled them to identify specific areas of mathematics that these pupils were finding particularly challenging.

Pupils' voice

An interview with a group of Year 6 pupils involved ten pupils from a city school, who had been identified as likely to attain level 4 in English but not mathematics. All but one of the pupils said they preferred English to mathematics as a subject, with many explaining that this was because they found it easier. Three pupils said that they enjoyed opportunities to be creative in English. When asked what they found easy and what was challenging in mathematics, many children identified addition as something they found easy, but found the other operations more difficult. Two pupils said that they found shape work easy and enjoyable. Almost everyone in the group agreed that fractions were challenging. When asked what helped them to learn mathematics, the ideas they discussed included:

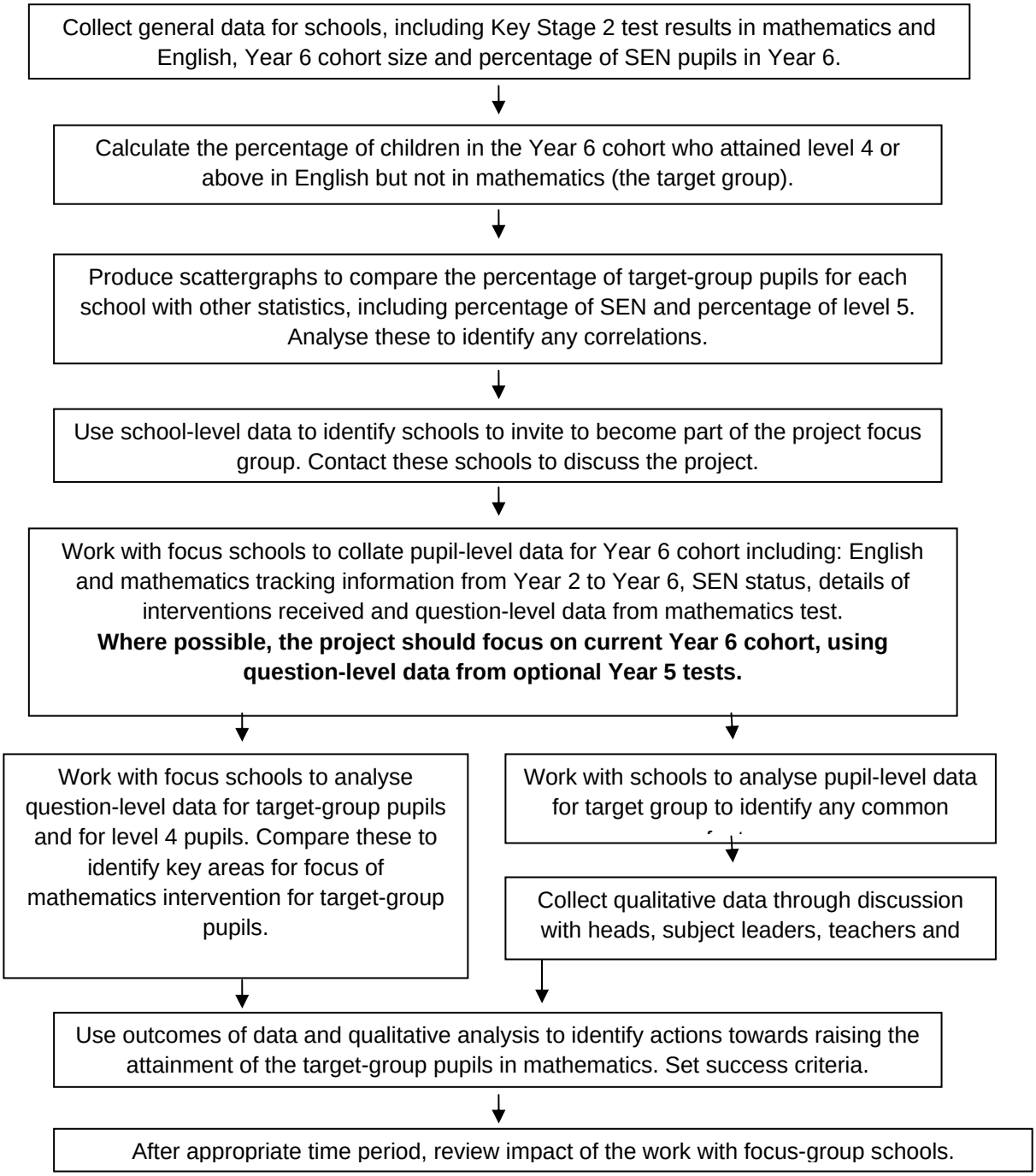
- using equipment to support their thinking
- the teacher explaining new ideas in different ways which they could discuss together
- the use of visual materials such as number lines to help them to understand mathematical ideas.

A further set of independent interviews was carried out by another researcher who interviewed a small group of girls who had attained level 4+ in English but not in mathematics. Full details can be found in Appendix D. The main findings were that the girls had positive attitudes towards English and valued the subject. In contrast, they lacked confidence in their own mathematics capability, did not enjoy the subject and did not see the subject as being of great value to their future lives. The appendix highlights the value of the

pupils' voice in identifying the reasons for underachievement and in helping to focus priorities and actions to narrow gaps in attainment in mathematics.

Appendix A

The research process involved in this project has proved a valuable one. It has provided an additional vehicle to support the schools in the focus group to reflect on strengths and areas for development in their teaching of mathematics. It is therefore hoped that local authorities may consider adopting a similar process as part of their ongoing school support programme. This flow chart summarises the model used in the research for this purpose.



Appendix B

For each question in the 2008 Year 6 national test, the percentage of target-group pupils (121 pupils) who answered correctly was compared to that of pupils who attained level 4 or above in English and a low to secure level 4 in mathematics (104 pupils). Questions where the difference between the attainment of the two groups was significant were then ranked.

Test	No	Level	Description of question	Question type	Question type 2	% difference
Highly significant difference in attainment						
A	6bii	3	Complete the sequence (X, 725, 800, 875, 950, X)	Number system		47%
B	15a	3	Use the chart to find how many children chose lemon yogurt	Handling data		46%
M	11	4	Ring around the decimal closest to 1/4 (choose 0.14, 0.24, 0.34, 0.44, 0.54)	Number system		44%
A	9a	4	Interpret bar chart to answer how many people have a birthday before July	Handling data		40%
M	12	4	How many sevens are there in 630?	Calculation		40%
A	9b	3	Use information and bar chart to answer how many have a birthday in December.	Handling data		39%
B	15b	3	Use the chart to find how many more chose raspberry than plain yogurt	Handling data		30%
B	18i	4	How many more small than large peaches can be bought for £5? Show workings	Problem solving	Calculation	32%
M	2	3	Subtract 21 from 40	Calculation		32%
B	23a	5	Solve the statement using the criteria given (simple algebraic representation used)	Calculation	Problem solving	33%
A	6i	3	Complete the sequence (X, 725, 800, 875, 950, X)	Number system		30%
B	18ii	4	How many more small than large peaches can be bought for £5? Show workings	Problem solving	Calculation	27%
B	17a	4	Read the scale to find the height of the water	Handling data		37%
B	10	3	Shade 1/5 of the diagram	Number system		33%
A	5b	4	Interpret the pictogram – how much more needed to reach target?	Handling data		33%
A	13	4	364 ÷ 7	Calculation		29%
B	17b	4	Read the scale to find the difference in water heights	Handling data		29%
A	5c	4	Round values on pictograms to the nearest £100	Handling data	Number system	33%
B	4ii	4	Find the cost of 6 cakes and 3 bottles of milk. Show working	Calculation		32%

B	16i	4	Solve money problem using statements	Calculation	Problem solving	33%
M	18	4	Multiply 75 by 20	Calculation		25%
B	7b	3	How much money does Nisha have?	Calculation		32%
A	11aii	4	Show workings for change from £20 if spending £7.95 and £4.50	Calculation		30%
B	7a	3	How much more money is needed to make £5?	Calculation		23%
B	14i	4	Reason the starting number from the given statement	Calculation	Problem solving	28%
M	16	3	Add together 90, 110 and 120	Calculation		26%
A	15a	4	Read the timetable to find how long it is from the end of break to the start of lunch	Calculation	Measures	30%
A	19b	5	What fraction of the diagram is shaded?	Number system	Problem solving	20%
M	7	3	What number is exactly half way between 50 and 80?	Number system		27%
A	16	4	45.3 x 6	Calculation		24%
A	10a	4	Circle the smallest number with is a multiple of both 2 and 7 (71-100)	Number system		28%
A	2	3	Join each calculation to the correct answer	Calculation		28%
A	1	3	Put times in order (5 mins, 20 secs, 1 min, 100 secs)	Measures		23%
M	13	4	What is 31.9 subtract 21.4?	Calculation		28%
B	6b	3	Use the bar line chart to find times when it was less than half full	Handling data		28%
B	9	4	Fill in the labels on the Carroll diagram	Handling data		28%
B	1ii	3	Join each number to the set it belongs (e.g 301 to 400, 401 to 500)	Number system		23%
M	1	3	How many hundreds are there in one thousand?	Number system		19%
M	17	4	Emily chose a number. She halved the number and then added 10 to the result. Her answer was 35. What was the number she started with?	Problem solving	Calculation	25%
M	5	5	What is three-quarters of 44?	Number system		20%
B	14ii	4	Reason the starting number from the given statement	Calculation	Problem solving	24%
A	8b	3	How many sheets of stickers are needed to have 55 stickers?	Calculation		23%
B	19	4	How much less than 1000 is 9.7 x 9.8 x 9.9?	Calculation		18%
A	11ai	4	Show workings for change from £20 if spending £7.95 and £4.50	Calculation		24%
A	11b	4	What is the most that could be paid for two scarves and a hat?	Calculation		16%
B	16ii	4	Solve money problem using statements	Calculation	Problem solving	25%
A	18a	5	Which number will be pointer be at after 150 degree turn?	Measures		25%
A	19a	5	What fraction of the diagram is shaded?	Number system	Problem solving	22%
A	20a	5	Interpret graph to find how many people lived in the town in 1985	Handling data		24%
B	23b	5	Solve the statement using the criteria given (simple algebraic representation used)	Problem solving	Calculation	11%
A	8c	3	On 10 sheets of stickers, how many more circles than rectangles are there?	Calculation		24%

B	4i	4	Find the cost of 6 cakes and 3 bottles of milk. Show working	Calculation		15%
B	22i	5	Find the multiple of 45 closest to 8,000. Show workings	Calculation	Problem solving	18%
A	10b	4	Circle the largest number which is a not multiple of 2, 3 or 5 (71-100)	Number system		21%
M	14	5	A rectangle has a width of 10cm and a length of 11cm. What is its area?	Shape and space		22%
A	17	4	How many cubes have grey faces in the model shown?	Problem solving		22%
A	12	4	Which two rectangles fit together to make a square?	Shape and space		22%
B	6a	3	Interpret the bar line chart	Handling data		12%
M	20	4	Three pens cost £1.50 altogether. How much would seven pens cost?	Calculation		20%
B	5	3	Tick the net if it makes a pyramid	Shape and space		19%
Significant difference in attainment						
M	3	4	What is 8 times 8?	Calculation		21%
M	10	4	Cakes are four for 50 pence. How many cakes will I get for £2?	Calculation		21%
A	5a	4	Interpret the pictogram – difference between values	Handling data		11%
B	3b	3	Join the analogue clock faces to the correct digital time given	Measures		21%
B	1i	3	Join each number to the set it belongs to (e.g. 301 to 400, 401 to 500)	Number system		13%
M	19	5	Subtract 0.05 from 0.5	Calculation		12%
B	11	4	Shade the pattern after a rotation	Shape and space		20%
B	22ii	5	Find the multiple of 45 closest to 8,000. Show workings	Calculation	Problem solving	10%
A	14	4	Use digit cards to make the decimal number nearest to 20 (9,4,1,2)	Number system	Problem solving	20%
A	15b	4	What time does Nisha leave the science lesson?	Calculation	Measures	14%
B	8	4	Reasoning about statement with odd/even numbers	Problem solving		18%
A	18b	5	How many degrees between 2 and 11?	Measures		8%
B	2	3	Identify the shape sorted incorrectly in the Venn diagram	Shape and space	Handling data	15%
A	7	4	Is it true that a four-sided shape is always a square? Explain	Shape and space	Problem solving	16%
Moderate difference in attainment						
M	6	3	Double 150 then double the answer	Calculation		9%
M	8	4	Add one pound twenty to two pounds seventy-eight	Calculation		13%
B	12i	4	Use the cards to complete the statements given (with < and > symbols)	Number system	Problem solving	13%
A	20b	5	Interpret graph to find in which year the number of people was the same as in 1950	Handling data		10%
M	15	5	What is 5% of 1000?	Number system		12%
M	9	4	What time is it 10 hours after 8pm?	Measures		14%

B	24i	5	Find the perimeter of a rectangle from a perimeter of the square. Show workings	Shape and space	Calculation	4%
B	24ii	5	Find the perimeter of a rectangle from a perimeter of the square. Show workings	Shape and space	Calculation	4%
A	8a	3	Multiply the number of stickers shown by 4	Calculation		6%
B	12ii	4	Use the cards to complete the statements given (with < and > symbols)	Number system	Problem solving	14%
B	3a	3	Join the analogue clock faces to the correct digital time given	Measures		11%
M	4	4	How many millimetres are there in three centimetres?	Measures		13%

Appendix C

An example of the feedback given to one of the focus-group schools based on question-level analysis of their 2008 Year 6 cohort

Whole-cohort feedback from analysis of 2008 Year 6 question-level test data

Strengths:

- Few questions were poorly answered
- Level 3 questions were generally solidly answered
- Children were able to count, add and subtract multiples of 10 effectively
- Attainment was high in data-handling questions
- Percentage questions were well answered

Weaknesses:

- In Shape and space, children struggled with questions involving transformations, visualisation and use of specific vocabulary such as ‘perpendicular’
- Children did not score well in the second part of many of the problems that involved two parts
- Calculation questions were not always well answered, particularly those involving decimals, multiplication and division, and understanding of inverse operations
- Children did not appear to be secure with use of the <> signs
- Percentages for Paper A and B were identical. In most schools attainment is higher in the calculator paper

Recommendations:

- Monitor teaching and learning of shape and space – are children being taught high enough level objectives and given regular opportunities to solve problems involving shape?
- Raising standards in calculation will have most impact on general attainment
- In particular, increase the focus on multiplication and division in Key Stage 2
- Increase children's confidence in using calculators to solve problems at top of Key Stage 2
- Use of APP materials (see below) to help teachers focus on expectations and progression would be valuable (focusing on Ma2 number would have most impact)
- In Year 6, give experience of 'I think of a number…' type questions involving use of inverses

- Ensure that long problems are regularly used as an integral part of each unit. These can be drawn from the Pitch and Expectations files on the National Strategies website.

Comments on target group (<L4 in mathematics but 4+ in English) compared to children who just achieved level 4 in mathematics and also achieved level 4 in English

Key areas of difference:

- Calculation questions that involved showing working as they involve three-digit or larger numbers
- Money problems that involved recording stages or using calculators
- Recall of multiplication and division facts
- Measures – understanding and use of units of measure and accurate reading of scales
- Shape and space – reflection in unusual grids, angle, nets of 3-D shapes
- Paper B and the mental paper were comparatively weak

Recommendations for similar pupils in current cohort:

- Extend the range of numbers with which children in this group are secure in calculating
- Ensure that this group has regular experience of using calculators to solve problems
- Use guided group work to model and develop strategies to solve multi-step problems
- In upper Key Stage 2, use *Overcoming barriers in Mathematics – helping children move from level 3 to level 4* materials

Appendix D

Interviewing children who attain level 4 in English but not in mathematics – the pupils' voice

This report discusses interviews with a small group of girls who achieved level four in the statutory tests for English in 2008 but failed to reach level four in mathematics. Its aim is to identify any common threads and to provide input to wider discussions around children who underperform in mathematics relative to English. The girls were children from two schools. Each of these schools generally achieves end of Key Stage 2 test results in line with or above national expectations. The girls were all articulate and keen to be involved in discussions and answer questions.

The group's views on English

Each of the children interviewed was very positive about their English or literacy lessons; comments included 'I'm really good at English', 'I like English' and 'I enjoy English' and the children's body language suggested very positive feelings towards this subject.

In response to the question about why they liked English the children all suggested that they were more confident with English and it was fun. One said she enjoyed using her imagination and particularly liked writing stories.

When asked if they felt that their teachers enjoyed teaching literacy, nearly all the girls responded that they thought they did. One child said that it was their teacher's big subject and her teacher was an expert in teaching literacy.

When asked why they thought it was important to do well in literacy or English, the children all said that it was important so you could learn in other subjects and that it would help you get a better job when you left school. One reported that she really enjoyed reading; another that she liked reading most types of books.

The group's views on mathematics

The children were much less positive in their views about mathematics. Half of the girls said that they hated it. One girl said it was all right, while another said that she quite liked it but was not very good at it. There was clearly less enthusiasm for mathematics than English. When asked why they felt like they did about mathematics, the girls who hated it became quite animated and said things such as 'It's boring', 'I can't see the point in it', 'I can't do it' and 'I don't understand it'.

When pressed a little further as to which parts of mathematics they found difficult the girls indicated that calculations were the most difficult thing for them. One said that she 'just didn't get fractions and decimals'. Generally the girls seemed to find multi-step questions difficult and admitted to a lack confidence. They were not able to recognise whether they had completed one part of the problem how they might use that information in the next step in the question. They could happily deal with the language but seemed to be unable to extract just what they were being asked to establish in each part of the problem.

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Nearly all of the girls said very similar things along the lines of 'I worry about getting things wrong and getting told off'. When asked if they had ever been told off for getting things wrong each answered that they hadn't. The girls associated strong emotional feelings with their work in mathematics. One girl said that it was just that 'when you get things wrong you feel bad about it'. She went on to say that she was not very confident about mathematics, and every time she got something wrong she felt less confident. When asked what would help her feel more confident she said that she didn't really know, but sometimes she felt better about mathematics when she didn't feel that she was going to get lots wrong. When the girls were asked if they liked mathematical games and puzzles, they said that they quite enjoyed them but had not done them very often.

The one girl who quite liked mathematics but was not very good at it said that she worried about making a silly mistake which would make her seem stupid. Sometimes 'clever' boys made fun of her answers.

When asked why it was important to be good at mathematics, the girls were less confident in their answers than when asked the same question about English. They did think it would help them in life, for example in shopping and working things out, but did not see a role for mathematics beyond these everyday activities. They added that some of the mathematics didn't really seem very useful at all.

Key points and implications from the interviews

It was clear from discussions that these girls were far more enthusiastic about English than mathematics. While there was some indication that the attitude of their teachers might have influenced their views and attitude to mathematics relative to English, there was no hard evidence that this was the case.

The clear theme running through the discussions was that these girls lacked confidence and this seemed to inhibit their ability to 'have a go' at problems and their motivation to do mathematics. They were all able and articulate girls who were well behaved and well mannered and generally wanted to do well, but they had little enthusiasm for mathematics and were held back by an unfounded fear of being told off for getting things wrong. Particular areas where they lacked confidence were in their ability to calculate and in their ability to solve problems. The attitude of other children, particularly boys, concerned them, while the differences in teachers' dispositions towards English and mathematics were alluded to by the girls.

Key issues emerging from the interviews

These discussions, while not large-scale or conducted under scientific and controlled conditions, did highlight a number of common issues around girls' perceptions of, and confidence in, mathematics. The following list sums up the actions that might be taken to address these emerging issues. While these apply to girls, they may also apply to all children.

- Giving children the confidence to 'have a go' and take risks by placing less emphasis on getting everything correct and recognising that making mistakes is part of learning in mathematics

- Engaging children in mathematics which through discussion and activity that poses less of a threat through use of more open questions, logical puzzles and areas of enquiry
- Sharing an interest in mathematics and explaining to children why mathematics is important, giving children a reason for doing the mathematics so that they are motivated to do it, particularly those areas of mathematics they find difficult
- Helping children to visualise the problems they are tackling through use of practical resources and models and images and where appropriate relating the mathematics to what they have already learned
- Building confidence and success within calculating, promoting approaches that enable children to choose whether to use mental methods, informal recordings and opportunities to use calculators, as well as the standard methods
- Helping children to recognise when they have reached part answers to multi-step questions and how they can use these answers to tackle the next step

Areas which could be investigated further

This series of discussions with girls on their views and perceptions of mathematics has raised a number of questions that warrant further investigation. These interviews were held with a small group of girls who had been successful in English, enjoyed the subject and held positive views on the teaching they had received. They thought the subject was of value to them. On the other hand, they had not attained the national expectation in mathematics and at the age of 11 had formed poor attitudes about the subject and low opinions about their own mathematics capabilities. However, there is strong evidence to show that for women to succeed in society they need some confidence in mathematics and be able to use a range of numeracy skills in the workplace.

- How do the attitudes of girls and boys who have been successful in English but not in mathematics differ?
- At what age do children form negative opinions about mathematics and what are the main contributing factors?
- How does the negative attitude of children towards mathematics impact on the attitudes of other children in their peer group, and vice versa?
- How might we change the perception of mathematics as a subject with right or wrong answers so that it is seen as a subject that promotes and values exploration and enquiry?
- To what extent are these children's views a reflection of their teachers' views?
- Are girls' attitudes to mathematics different in those classrooms where there is more emphasis on the use and application of mathematics?
- Are there particular approaches to the teaching and learning of calculation and problem solving that are more appropriate for girls?

Conclusions and challenges

Although small in scale, this study has shown some possible avenues for further exploration. Furthermore, its findings support some of the findings of the main body of the report and it raises several possible issues which are important when considering ways of 'narrowing the gap' in attainment between boys and girls in particular.

Through this interviewing process we have shown that by targeting children from a well-defined group of children – in this case, girls who attained level 4+ in English but not in mathematics – and listening to the children's voice, we can learn more about their views and perceptions about mathematics. This in turn provides us with evidence that draws attention to possible actions we might take to strengthen provision in a way that leads to improved confidence and attitudes and results in higher attainment in mathematics. In this particular study we have drawn out common issues that we think apply nationally to all girls who fall into the target group. However, there will be local issues too that will need addressing, that might involve a group of schools, a school, a classroom or even a peer group in the classroom.

There are other groups of children we can target, whose voices we might listen to and learn from in a similar way. The focus here has been on narrowing an identified gap in attainment in mathematics. There are other gaps we might address in a similar way. Certainly as part of this process there should be opportunity to capture the pupils' voice. The process is similar to the overall model outlined in Appendix A and involves:

- data analysis, to identify underperforming groups of children
- selecting a well-defined target group of underachieving children
- approaching schools to engage in the interview process explaining the purposes of the process and the benefits of being engaged
- with the school, identifying children in the target group who with their agreement are to be interviewed
- involving the school in the interview process and together analysing the outcomes
- sharing the findings with the senior leadership in the school to identify priorities and actions to take to improve the attainment of children who fall into, or are in danger of falling into, the well-defined target group of underachieving children
- agreeing success criteria and timelines for actions and review of impact on provision and attainment.