

The design of the Primary National Strategy Wave 3 mathematics materials

Guiding principles

The materials evolved as feedback was provided through pilot LEAs and in response to relevant research.

The guiding principles informing the design are:

- flexibility so that teachers can adapt them;
- sharing the purpose of each activity with the child to encourage reflection on, and ownership of, learning;
- highlighting and modelling key vocabulary throughout;
- teaching activities finishing with related activities for whole-class use, where appropriate;
- use of a variety of images and models, aiming to include some the child may not have met before;

- linking mathematics to familiar and relevant contexts;
- integrating and exemplifying mathematical problem solving;
- inclusion of games among teaching activities, possibly for sharing with parents and carers.

Mathematical themes

The following are fundamental to the approach.

- Using and applying mathematics has been integrated. Often there are several opportunities for problem-solving within one activity, but in each, one particular opportunity has been highlighted. Aspects such as the following are incorporated:
 - encouraging children to discuss and explain in order to support development of their mathematical reasoning;
 - opportunities for children to make choices are woven into the activities, for example selecting numbers and devising calculations;
 - encouraging children's own recording to communicate mathematical thinking, focusing on efficiency;
 - opportunities for evaluating the efficiency of methods of calculation.
- Development is emphasised and key vocabulary is listed in each activity. It is important for adults to use correct mathematical language. To facilitate this, examples are given in words, for example, ' 725×3 ' is accompanied by what the adult could say to the child: 'Seven hundred and twenty-five *multiplied by 3*'.
- There is a focus on progression in counting from the earliest stages through to Year 6 to support the development of secure counting skills.
- Throughout the materials, there is emphasis on the process of estimating first, then calculating and then checking. This is denoted by the following icon:



- Decimals are addressed within meaningful contexts, for example via displays on a calculator and as a part of measure.
- Structured equipment and everyday materials are used to model mathematical concepts, supporting children's mathematical thinking and development of mental imagery. Some links to ICT resources such as the Primary National Strategy Interactive Teaching Programs (ITPs) are included.
- A wide range of resources is used in the teaching sessions. Teachers' selection of these to suit the needs of their children is an important part of adapting the materials.

Assessment overview

The materials reflect best practice in assessment for learning as a key tool for raising achievement through:

- use of questions to elicit information about children's understanding;
- sharing the purpose of the activity with the learners;
- encouraging children's reflection on their learning and identification for themselves of possible next steps.

Details of the materials' structure

The materials focus on a selection of the key objectives in National Numeracy Strategy *Framework for teaching mathematics*, namely, addition and subtraction, and multiplication and division objectives. Research shows that children's difficulties with calculation are highly susceptible to intervention and that individualised work with children who are falling behind in number and calculation has a significant influence on their performance.

In order **to exemplify progression in calculation, Reception, Year 2, Year 4 and Year 6 have been chosen as representative milestones**. Under each year group heading, associated knowledge and skills that contribute to understanding of the year group key objective are listed. (See first column of tracking chart.)

The whole primary age range is represented in the progression in the chart. The year group labels provide a convenient link to the National Numeracy Strategy *Framework for teaching mathematics* progression in number and calculation. As they use the chart, teachers will need to 'track back' to find the error or misconception appropriate for the child, **irrespective of the year group to which it is attributed in the progression**.

Tracking charts

1 → Tracking children's learning through the NNS Framework for teaching mathematics (addition and subtraction)

Associated knowledge and skills	Errors and misconceptions	Questions to identify errors and misconceptions	Teaching to address the errors and misconceptions	Next steps in moving towards the key objective
<p>Apply knowledge of the number system to enable efficient counting of a large number of objects.</p> <p>Add and subtract multiples of ten, a hundred and a thousand.</p> <p>1 Y6</p>	<p>Has inefficient counting strategies and/or insecure understanding of the number system.</p> <p>1 Y6 v/r</p>	<p>Imagine you have a money box containing 2p and 1p coins. What do you think would be a good way to count these quickly to find out how much money there is?</p> <p>What is $60 + 207 \dots 60 + 307 \dots 60 + 407$? What changed when you found $60 + 407$?</p> <p>What is $40 + 407 \dots 400 + 407$? Which answer is the larger? How is the calculation $40 + 400 + 4000$ different from the others?</p> <p>What is $60 - 207 \dots 600 - 2007 \dots 6000 - 20007$? Explain how you worked these out. What is $6000 - 2007 \dots 6000 - 207$?</p>	<p>Practical opportunities to develop efficient counting strategies for a range of objects, for example coins, cubes, conkers, collectable cards, stickers.</p> <p>Count forwards and backwards in tens, hundreds and thousands from different starting points, including starting numbers that are not multiples of ten or a hundred. Use an empty number line to support this development.</p> <p>Order multiples of a hundred and a thousand.</p>	<p>Carry out simple calculations that involve crossing the boundary from hundreds to one thousand and vice versa, supported by an empty number line and extending this to a visualised image to develop mental calculation.</p>
<p>Give an estimate by rounding, to determine whether the answer to a calculation is sensible.</p> <p>2 Y6</p>	<p>Rounding inaccurately, particularly when decimals are involved, and having little sense of the size of the numbers involved.</p> <p>2 Y6 v/r</p>	<p>Is 26 nearer to 20 or 30? Is 271 nearer 270 or 280? Is 1.8 nearer to 1 or 2? Draw a sketch to illustrate your answer and explain how you know.</p>	<p>Use number squares and/or number lines to consider the order and comparative value of numbers to support rounding.</p>	<p>Consider pairs of items from a catalogue and ask child to estimate whether a £10 (or £20, etc.) note would be enough to buy both the items?</p>

2 → 3 → 4 → 5 → 6 → 7 →

- 1 Key objective.
- 2 This column lists associated knowledge and skills that contribute to understanding of the key objective.
- 3 Common errors and misconceptions linked to specific knowledge and skills are listed to support diagnosis of children's difficulties.
- 4 Questions in this column can be used to help the teacher decide where the child's difficulties lie.
- 5 Examples of the types of teaching activity in the A4 booklets (see below).
- 6 This column provides ideas to develop when the child has improved their understanding of the identified difficulty. The teacher can make use of these ideas to consolidate understanding and extend thinking.
- 7 Code referencing to an A4 teaching unit.

Six essential areas to support a child's learning in calculation are the basis of the Primary National Strategy *Using models and images to support mathematics teaching and learning in Years 1 to 3* (DfES 0508-2003 GCDI) and the focus on

these is reinforced in the Wave 3 mathematics pack.

These areas are:

- ordering numbers;
- counting on and back;
- partitioning and recombining;
- addition and subtraction facts within 20 (not just those that total 20);
- understanding of the four operations;
- problem-solving strategies.

A4 booklets – teaching units

The structure of each booklet is as follows:

- focus error/misconception;
- opening teaching activity addressing error/misconception;
- a number of Spotlights (short focused teaching activities from which to select);
- final Spotlight, which includes assessment opportunities, often encompassed in a game, key vocabulary checklist, and intended learning outcomes list.

Opening teaching activity

Spotlight

Specific icons are used to improve access to the text:

Icons

 **Questions are incorporated for teachers to select from and add their own as appropriate.**



Whole-class follow-on activity.



Symbol reminding of the necessity to estimate, calculate, then check.



This variation of the game is harder.



This variation of the game is easier.

$12 \times 2 = 24$

Text within this symbol indicates an opportunity for recording.



Text within a shaded box indicates alternative approaches for a child who is having difficulty with the activity.



Additional game at the end of some teaching units.