Hampshire Services
HIAS SCHOOL IMPROVEMENT

Dyscalculia

Provision in the classroom

Dyscalculia

What is it?

Dyscalculia is often called a 'maths' difficulty, but it actually only affects those aspects of mathematics to do with number. A dyscalculic learner may have no problems with shape and space but be unable to recall or use a basic addition number bond. It would therefore be better to think of dyscalculia as a specific difficulty with number and arithmetic.

The Department for Education and Science first recognised developmental dyscalculia in 2001. It was defined as:

'a condition that affects the ability to acquire arithmetical skills. Dyscalculia learners may have difficulty in understanding simple number concepts, lack an intuitive grasp of numbers, and have problems learning number facts and procedures. Even if they produce a correct answer, or use a correct method, they may do so mechanically and without confidence'
(DfES 0512/2001, p.2)

Research into dyscalculia is still at an early stage, but it is estimated that it affects roughly 4-6% of the population. This equates to at least one child in any average class. The above definition may leave you feeling that the majority of your class are dyscalculic on some days ! The first question to address is how are dyscalculia learners different from learners experiencing everyday difficulties with new concepts or procedures in maths ? A dyscalculic learner stands out as having:

- no feel for numbers at all
- no ability to estimate even small quantities, and
- no idea whether their answer to an arithmetic problem is reasonable or not

Dyscalculia learners often have memory weaknesses, both long-term and short-term. This results in the learner being:

- unable to remember facts and procedures accurately or consistently
- unable to derive associated facts, such as times tables
- able to recall number facts one day but not the next
- likely to lose track of what they are doing when attempting a procedure that requires two or three steps
- unable to count, even basic forwards counting, although counting backwards is most often the problem

The indicators for dyscalculia:

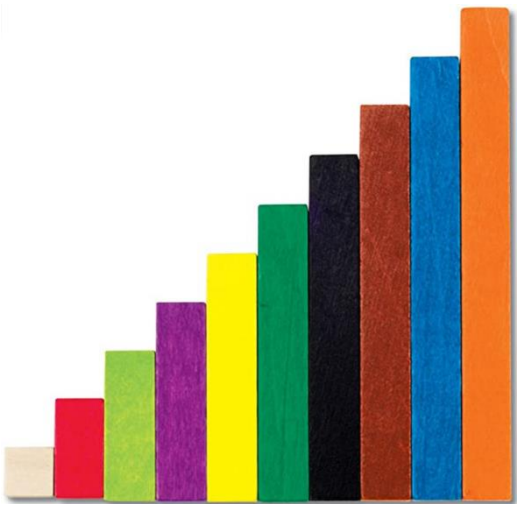
This list is not exhaustive but includes the most common indicators. Learners may show some, but not all, of these characteristics and behaviours:

- an inability to subitise (see without counting) even very small quantities
- an inability to estimate whether a numerical answer is reasonable
- weaknesses in both short-term and long-term memory
- an inability to count backwards reliably
- a weakness in visual and spatial orientation
- directional (left/right) confusion
- slow processing speed when engaged in maths activities
- trouble with sequencing
- a tendency not to notice patterns
- a problem with all aspects of money
- a marked delay in learning to read a clock to tell the time
- an inability to manage time in daily life

What kind of teaching do dyscalculic learners need?

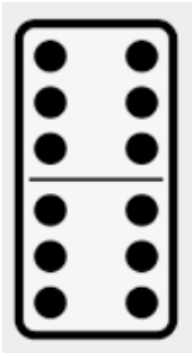
All numeracy teaching should aim to help learners build up a sound mathematical understanding of numbers and their relationships. With dyscalculic learners, a focus on numeracy and arithmetic is important starting- crucially- with a variety of versatile concrete materials that provide practical experience and clear visual models. Once a learner can manipulate the concrete materials and images with some understanding, it may be possible to move forward into a more abstract or symbolic method.

A versatile and powerful tool to support learners struggling to build a coherent mental model of the number system is Cuisenaire rods. The rods should be supplemented with discrete counting objects, such as counters, for arranging and re-arranging into dot patterns for those who are not yet ready to use the rods. When learners are more secure with the rods, the use of Dienes blocks, or other base-10 equipment is helpful. One of the great strengths of Cuisenaire is that numbers are not presented as a collection of ones, so the learner's focus is directed away from counting and towards number relationships.



It is important that teachers beware of the 'counting trap', dyscalculic learners cannot necessarily memorise the word strings associated with counting. They need to develop an ability to pattern

spot and one of the best ways to do this is to use dice, dominoes, and dot patterns with counters. This can improve recognition of spot patterns, rather than expect the learner to recall and chant for counting.



Double six is twelve modelled with dot patterns on dominoes and dice

Rote counting for a dyscalculic may mean that they must always ‘count all’ when trying to calculate, rather than progress to ‘counting on’, for example. Using recognition of dot patterns and practising visualisation may help with this.

It is worth noting that problems with numeracy often go hand-in-hand with significant memory and processing weaknesses. This is why simple repetition will never be a way forward for dyscalculic learners. It is likely to be much more helpful to focus on only a few key facts, those that are most important or have the widest application. The teaching strategy would be to allow the learner to explore and internalise the key facts through multi-representations and dual coding using verbal and visual prompts. Then teach them explicitly how to derive other key facts by logical reasoning in small steps.

For dyscalculics, visualisation is a strategy that needs to be explicitly taught as a route towards mental calculations. One approach is to follow any work with concrete resources with a short session where the learner closes their eyes and recalls what they have seen, they then represent this in picture or diagrammatic form. For example, if we are building number bonds to 10 using different coloured inter-locking cubes to create a ’10 tower’, then we might ask the learner to recollect this mentally and then draw on squared paper.

HIAS resources to support diagnosis of difficulties and small steps planning.

The HIAS maths team offers a range of resources to support teachers with provision for learners with dyscalculia. This includes a series of toolkits for primary and secondary learners to support planning in small incremental steps. In the Year 1 example below, small steps towards end of year 1 expectations are identified to enable the teacher to break down objectives and focus on a few key ideas at any one time.

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Year 1 Planning Tool

Number and Place Value

Year 1: National Curriculum notes and guidance (non-statutory)

Pupils practise counting (1, 2, 3…), ordering, (eg first, second, third…), and to indicate a quantity, (eg 3 apples, 2 centimetres), including solving simple concrete problems, until they are fluent.

Pupils begin to recognise place value in numbers beyond 20 by reading, writing, counting and comparing numbers up to 100, supported by objects and pictorial representations.

They practise counting as reciting numbers and counting as enumerating objects, and counting in twos, fives and tens from different multiples to develop their recognition of patterns in the number system, (eg odd and even numbers), including varied and frequent practice through increasingly complex questions.

They recognise and create repeating patterns with objects and with shapes.

Key concepts

- The order of numbers enables comparison between numbers.
- As you count on the quantity represented by the number becomes larger and becomes smaller as you count back.
- Numbers greater than 9 are formed by combining more than one digit and numbers between 10 and 20 start with a '1'.
- The position of a digit in a number indicates its value.
- The place value system is based on units of 10.
- Knowing number names /reading teens numbers can be confusing in terms of place value, eg 11, 12, 13, 14.

Curriculum strands

Within the document, the national curriculum programme of study domain number and place value is broken down into smaller curriculum strands to support precise identification of need. The curriculum strands identified are:

- counting
- comparing numbers
- identifying, representing and estimating numbers
- reading and writing numbers
- understanding place value

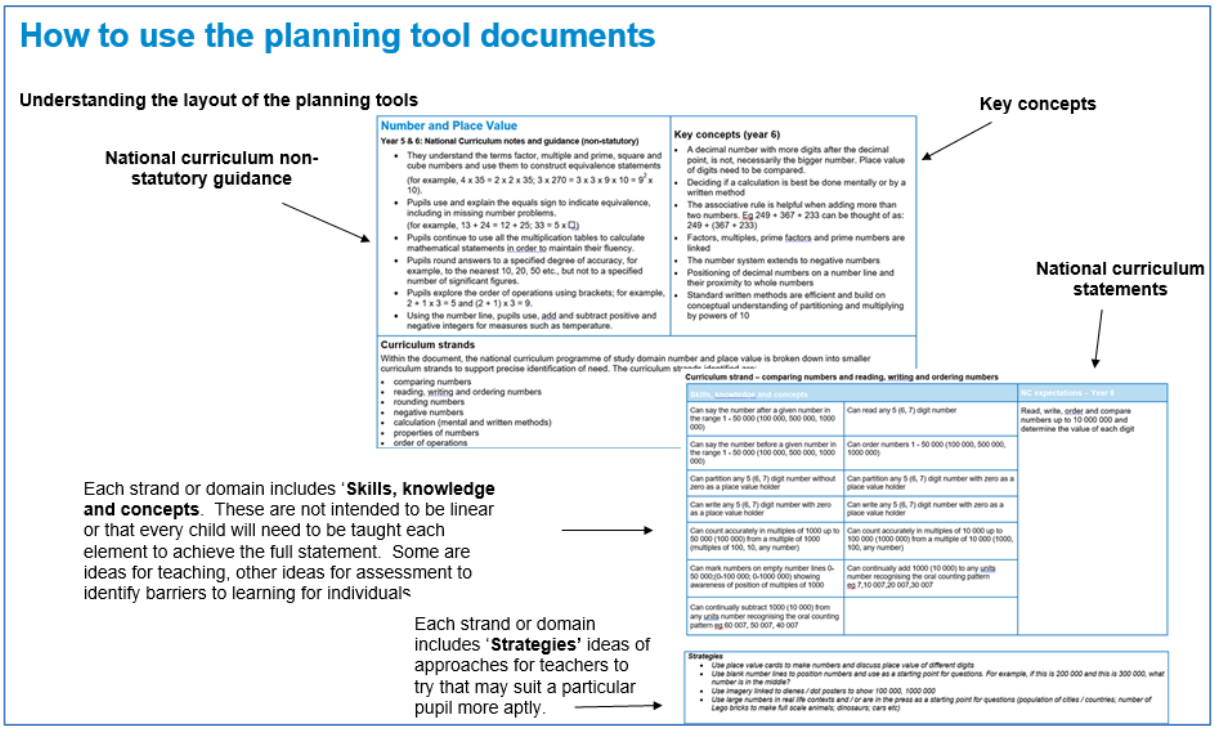
Problem-solving

Teacher assessment should consider to what extent the pupil is able to apply conceptual understanding of number and place value to solve problems.

In the secondary resource for SEND, the foundations for secondary have been identified from the primary curriculum and small steps towards end of year attainment are exemplified.

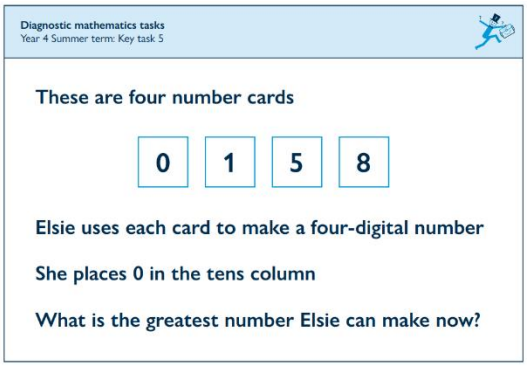
Curriculum strand – Counting

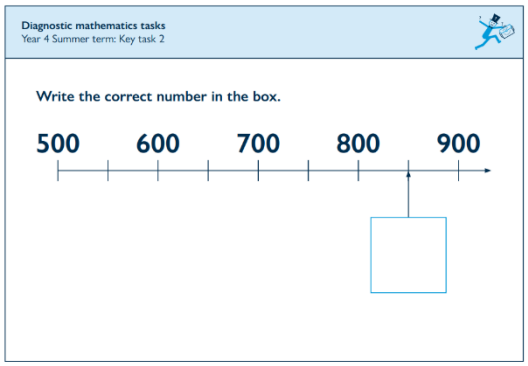
Skills, knowledge and concepts		NC expectations – Year 1
Can say the number sequence from 1-10 (1-20, 1-30, 1-100).	Can say the number sequence backwards from 10-1 (20-1, 30-1, 100-1).	Count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number.
Within the range 1- 10 (1-20, 30-1, 1-100) can count forwards from a given number to another given number.	Within the range 10- 1 (20-1, 30-1, 100-1) can count backwards from a given number to another given number.	Count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens.
Can say the number after a given number in the range 1-10 (1-20, 1-30, 1-100) without dropping back to 1.	Can say the number before a given number in the range 1-10 (1-20, 1-30, 1-100) without counting up through all numbers first.	Given a number, identify one more and one less.
Recognises patterns in the number sequences from 1-20 (1-30, 1-100) and uses this to say them/ self-correct.	Can find 10 more than any given number U + 10 = ? (teen numbers), (10-20).	
Points to or moves objects when counting.	Can find 1 less than any number up to 10.	
Can count accurately up to 3/ 4 (10, 20, 30) objects.	Can find 1 less than any number up to 20.	
Can count for a short sequence in multiples of 2 (5).	Uses step counting to count larger groups of objects (2s, 10s).	



In addition to this, the HIAS maths team has produced a series of diagnostic packs to support teachers with identifying barriers to progress in key areas of mathematics for all learners from Y1 to Y11.

This resource has been designed to support teachers in using diagnostic assessment to inform teaching that addresses significant gaps in pupil learning. The example task cards are taken from the Y4 to Y5 materials. The booklets contain a series of mathematical questions and activities covering a range of mathematical domains, which enable teachers to progressively explore pupils' knowledge, conceptual understanding, and skills from the end of the summer term in one year group to the spring term in the next year group. The resource encourages the use of tightly focussed practical activities that address one idea at a time to ensure accurate diagnosis of a mathematical difficulty and provision for each individual learner.





The key message for what works best for dyscalculic learners is to:

- **break down** every bit of teaching and learning into very small incremental steps, and to not make any assumptions about what is already known or internalised

- **minimise** the number of facts that you expect to be committed to memory, focussing on games and activities rather than abstract worksheets. It is important not rush into abstract or written work too soon.

As with all learners, sound numerical understanding can only develop if it rests on secure foundations at every stage.

References:

Bird, R (2017) 'The Dyscalculia Toolkit' Sage publishing *ISBN 978-1-4739 - 7426 -5*
HIAS Maths Planning Tool for pupils with SEND
HIAS Maths Diagnostic Questions packs.

HIAS Maths Team

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For further details on the full range of services available please contact us using the following email:

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