

# **DYSCALCULIA**

## Pocketbook

**By Judy Hornigold**

Cartoons:  
Phil Hailstone



# Contents

Page

	<b>What is Dyscalculia?</b>	Explaining dyscalculia, common difficulties, definitions, common themes, how common is dyscalculia?, what causes dyscalculia?, what is dyscalculia and what isn't?, subtypes of developmental dyscalculia and ways to help	<b>7</b>
	<b>Identification</b>	Key indicators of dyscalculia, subitising, number sense, how to identify learners with dyscalculia, checklists, observation and error analysis, screening tools, inchworms and grasshoppers, informal assessment, full diagnostic assessment	<b>35</b>
	<b>Dyscalculia and Maths Anxiety</b>	Negative memories, defining maths anxiety, causes, how to identify it, how to overcome it, making the most of mistakes	<b>59</b>
	<b>Teaching Strategies</b>	Multi-sensory teaching, overlearning and the spiral curriculum, making links, using concrete materials, knowledge representation, three components of a mathematical idea: language, concept and procedure, six levels of knowledge – intuitive, concrete , pictorial, abstract, application and communication, questioning technique, number talks	<b>69</b>
	<b>Top Ten Tips</b>	Make it real, take your time, make it fun, look for the short route, say what you see, make it multi-sensory, focus on place value, keep talking and develop metacognition, little and often, reduce memory load	<b>91</b>
	<b>Games and Next Steps</b>	A compendium of quick, easy games to help develop number sense, place value and other maths skills, develop curiosity, provide a 'wow' moment, the way forward	<b>105</b>
	<b>Further Information</b>	Training, recommended reading, websites, resources and IT resources, references, glossary, about the author	<b>119</b>

# Subtypes of developmental dyscalculia



Returning to developmental dyscalculia proper, several researchers have put forward their ideas for dividing dyscalculia into subtypes to try to explore and explain the condition further.

Dyscalculia can affect different aspects of maths ability – leading to a variety of maths profiles. Karagiannakis and Cooreman (2014) have identified four areas or subtypes. Dyscalculic learners may have difficulty in all or maybe just one or two of these areas:



1. Core number



2. Reasoning



3. Memory



4. Visual spatial



# 1. Core Number



This particular subtype of dyscalculia will lead to difficulties with:

- Basic number sense, ie the ability to use and understand number and our number system
- Estimating
- Assessing difference in numerical quantity, eg understanding that 230 is ten times as much as 23 or that 9 is larger than 7
- Understanding and using mathematical symbols
- Understanding place value, eg being able to write 304 in response to hearing three hundred and four rather than writing 3004
- Placing numbers on a number line, ie understanding that 5 would be placed in the middle of a number line from 0 to 10



## Ways to help with core number



- Provide activities that focus on the **connection between numbers** as quantities and as symbols. For instance, give the learner a card with the number 3 on then get them to jump 3 times, to take 3 steps, to find 3 apples, etc
- Practise **rounding numbers** to encourage estimation. For example if the calculation is  $387 \times 43$ , encourage the learner to see this as  $400 \times 40$ . The process of rounding and estimating can be more beneficial than actually carrying out the calculation
- Use **base ten materials** to support the understanding of place value, and physically show the numbers. Let's say the calculation is  $2345 + 1673$ , set this out with the correct number of 1000 cubes, 100 squares, 10 rods and unit cubes
- **Encourage verbalisation** so that the learner is telling you what they are doing and why, when they are working with numbers. This can help you to identify any misconceptions and can help the learner to identify gaps in their understanding





## 2. Reasoning



This particular subtype of dyscalculia will lead to difficulties with:

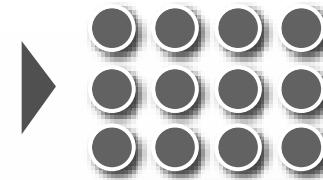
- Understanding mathematical concepts and relationships, eg understanding that multiplication is repeated addition or that addition and subtraction are inverse operations
- Generalising and transferring information, eg using the fact that  $5 + 4 = 9$  to work out that  $50 + 40 = 90$  or that  $5 + 5 = 10$
- Understanding multiple steps in complex procedures/ algorithms
- Problem solving and decision making



## Ways to help with reasoning



- Make the maths real by explicitly demonstrating the link between maths and everyday situations
- Represent the maths concept with diagrams and manipulatives, eg showing  $4 \times 3$  as an array
- Encourage verbalisation of mathematical processes and develop metacognition. Discuss strategies that work for the learner so that they can understand how they learn and which methods work best for them
- Use role play to model mathematical scenarios and encourage mathematical thinking, eg acting out word problems, or giving and receiving change in a shop





## 3. Memory



This particular subtype of dyscalculia will lead to difficulties with:

- Remembering and retrieving numerical facts, eg recall of number bonds to ten or times tables
- Understanding and recalling mathematical terminology
- Understanding word problems. Making sense of a word problem often requires retention of information in short-term memory
- Performing mental calculations accurately. Mental arithmetic places considerable demands on the working memory
- Remembering and carrying out procedures as well as rules and formulae
- Keeping track of the steps in problem solving



## Ways to help with memory



- Use decision-making flowcharts to help recall of processes and procedures
- Use diagrams and tables to help visualise the maths
- Use concrete materials, such as Numicon and Cuisenaire rods to model the maths
- Memorise the how and the why rather than just the what. It's much easier to remember something if we understand it and can explain it
- Encourage overlearning by using a 'little and often' approach and memory cards. Some learners find it useful to make a set of cards to remind them of facts and procedures. These could show tricky times table facts such as  $7 \times 8 = 56$ , or could explain the meaning of mathematical terms such as 'numerator'

# About the author

## Judy Hornigold BSc, PGCE, AMBDA



Judy is an independent educational consultant specialising in dyscalculia and dyslexia. She is particularly passionate about the teaching of maths and of finding ways to support learners with dyscalculia and general maths learning difficulties. Judy has written the PGCert in Dyscalculia and Maths Learning Difficulties for Edge Hill University, which is the first of its kind to be accredited by the British Dyslexia Association, and the Level 2, three-day dyscalculia course for the BDA.

Judy lectures on Inclusion for Edge Hill University and is an Associate Tutor for the BDA. She also delivers lectures and workshops throughout the UK and internationally. She has written two books of lesson plans for learners with dyscalculia as well as a guide for parents of children with dyslexia.

More recently, Judy has been training for Maths No Problem, on the Singapore approach to Maths and is currently researching how this approach supports learners with dyscalculia. She can be contacted via her website [www.judyhornigold.co.uk](http://www.judyhornigold.co.uk)