

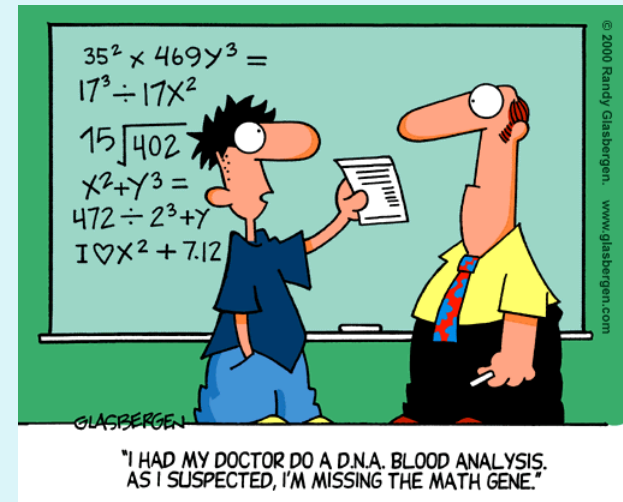
Dyslexia and Maths Learning Difficulties

Who do you know?



What is dyscalculia?

- Dyslexia for numbers
- Little known about prevalence, causes or treatment.
- Current thinking - congenital condition, caused by the abnormal functioning of a specific area of the brain.
- Dyscalculics - great difficulty with the most basic aspects of numbers and arithmetic.
- Best estimates indicate that somewhere between 3% and 6% of the population are affected.



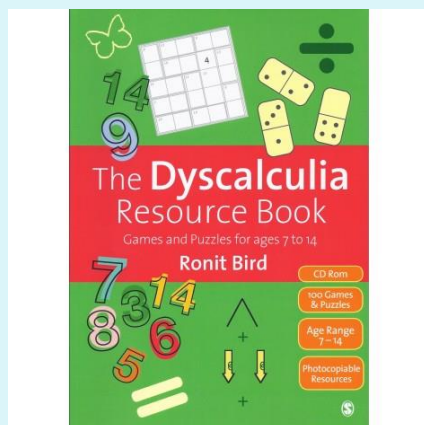
Definition

"Dyscalculia is a condition that affects the ability to acquire arithmetical skills. Dyscalculic learners may have difficulty 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

Features of dyscalculia

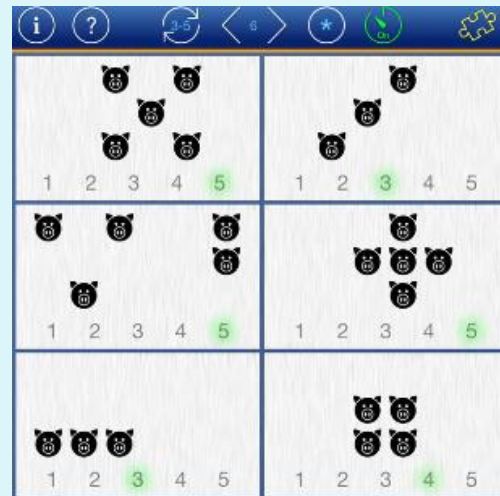
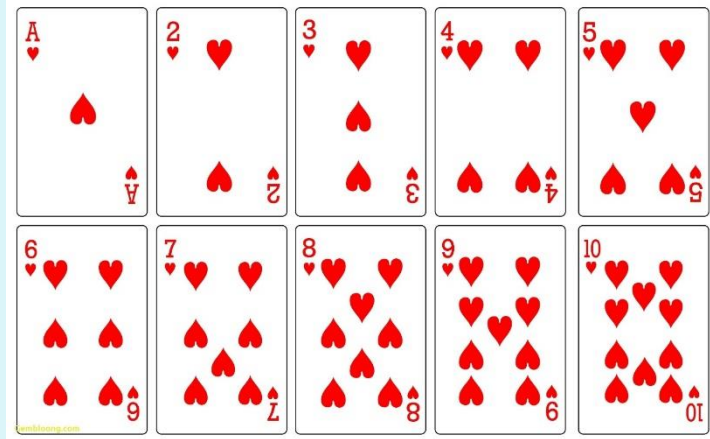
<http://www.ronitbird.com/videos/>



Tips for teachers & parents

Books

Subitising



Dyslexics with numeracy difficulties

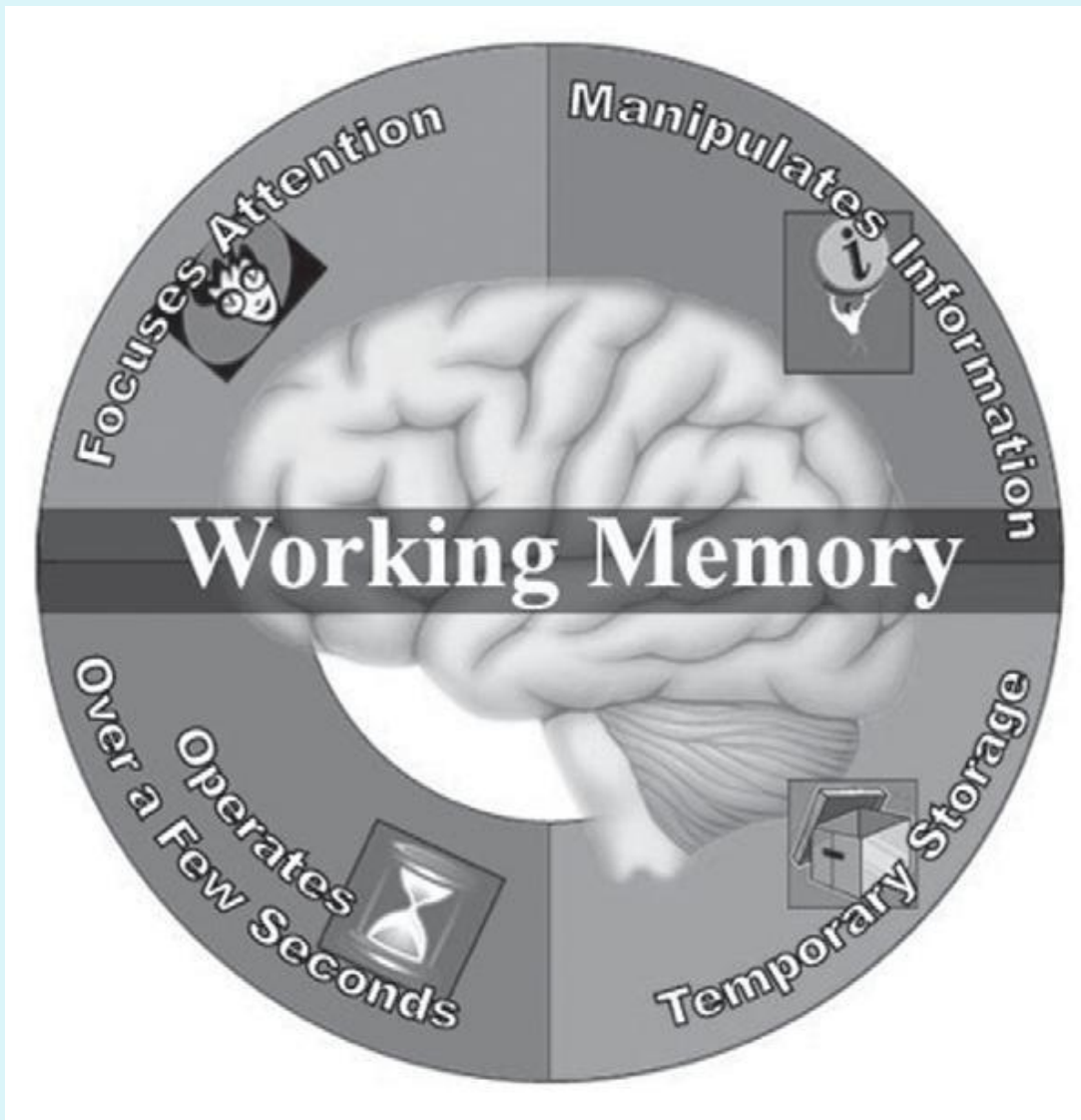
- *"...the difficulties experienced by dyslexics in mathematics are manifestations of the same limitation which also affects their reading and spelling." (Miles & Miles, 1992)*
- 50-60% learners with dyslexia have numeracy difficulties

Possible issues for dyslexics

- Language
- Memory difficulties (long, short, working)
- Left / right confusion (direction)
- Sequencing
- Spatial awareness
- Telling the time
- Handling money and measurements
- Visual
- Recording answers
- Organisation
- Speed of working
- Attention skills may be a factor
- Self esteem / motivation

What else impacts on ability to learn maths?

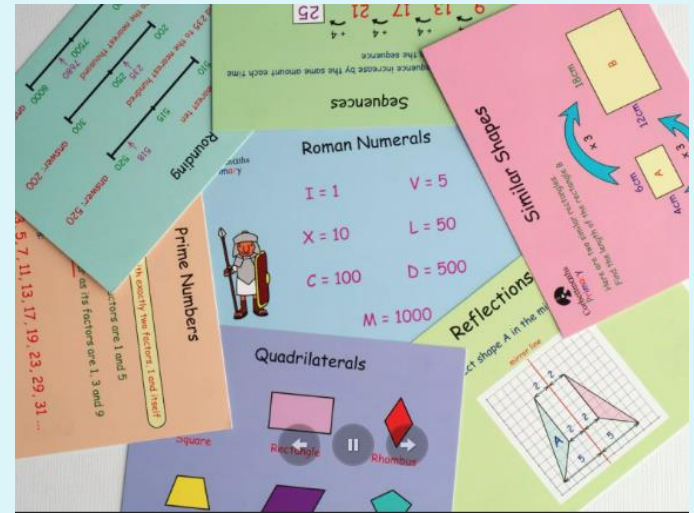
- self-belief
- low attendance
- poor teaching
- behavioural / attention problems
- **reduced working memory capacity**
- high anxiety
- fixed mindset



Components of the working memory system. Introduction to Working Memory (WM), D. B. Berch

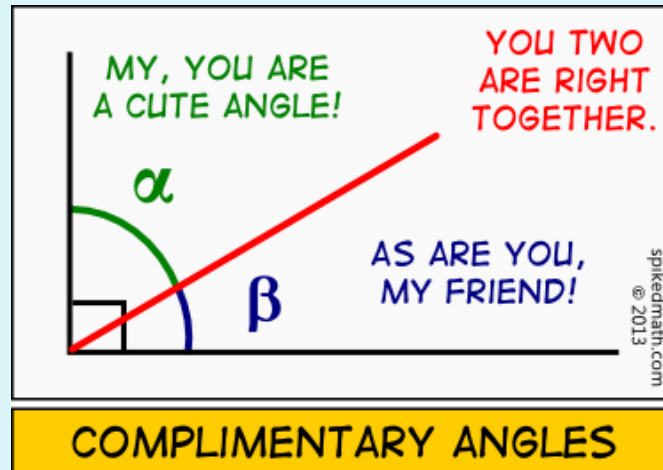
Support weak working memory

- Hands on resources
- Support visually
- Reduce time pressure (and stress)
- Aids e.g. calculators, tables square
- Learn to draw speedy tables square
- Fact cards
- Opportunities for revision/reinforcement



- Types of angles
- <https://corbettmathsprimary.com/2018/05/30/types-of-angle-video/>

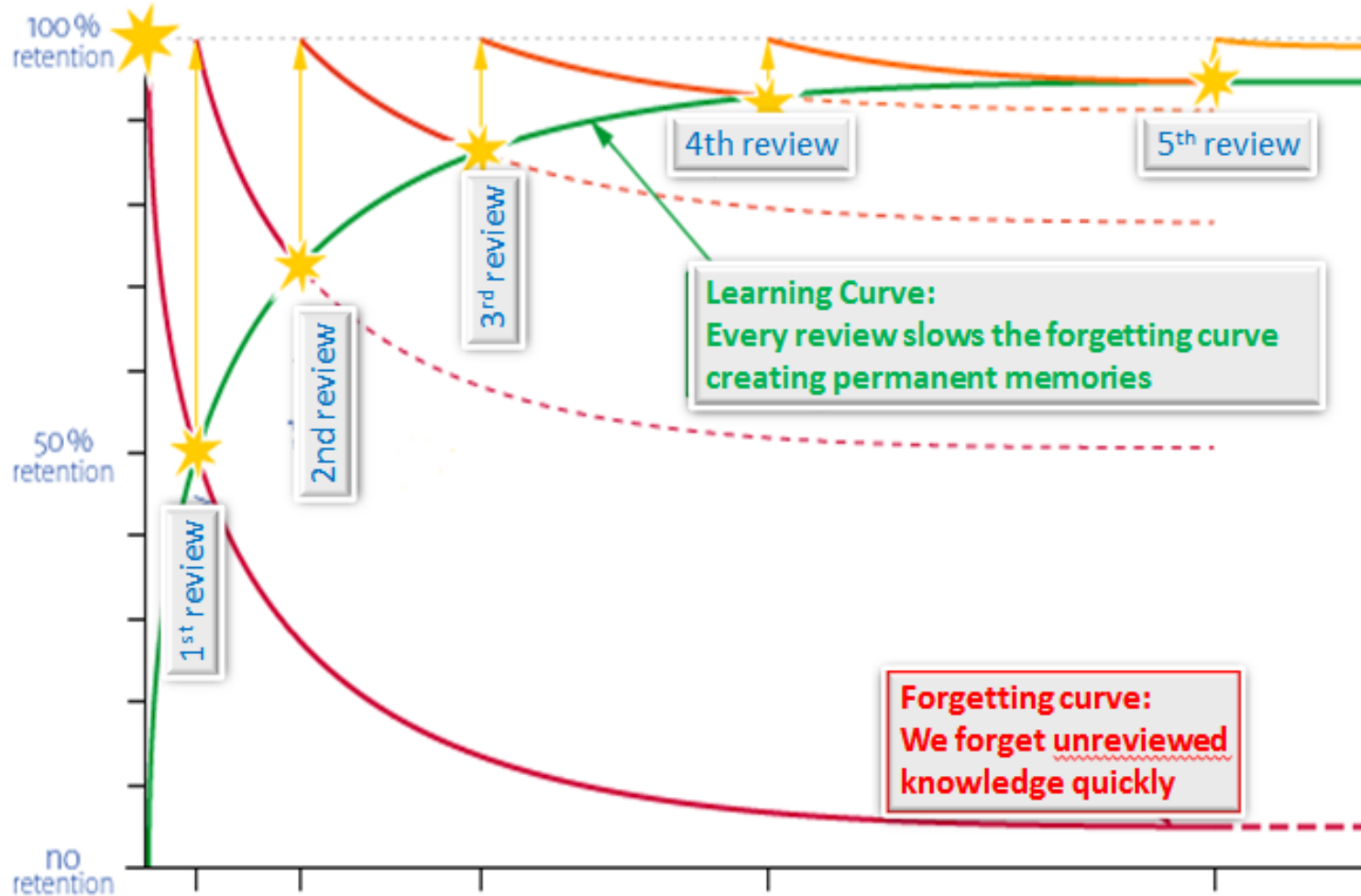
- QR code



Why spaced review works

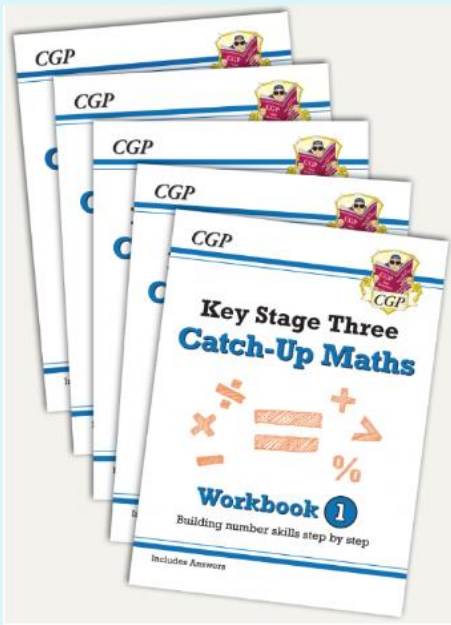
kidocs.org

www.LearnThat.org, a LearnThat Foundation project



Dyslexia Outreach
SERVICE

CGP Publications



Exercise 2

Finding equivalent fractions

Fractions that look different but show the same amount of a whole are called equivalent fractions. Each circle below has a different fraction shaded, but the same amount shaded.

One half
Two quarters
Six twelfths

To find equivalent fractions, multiply or divide the top and bottom of a fraction by the same number.

$$\frac{1}{2} \stackrel{\times 2}{=} \frac{2}{4} \stackrel{\times 3}{=} \frac{6}{12}$$

1 Shade the second shape and fill in the blanks to show equivalent fractions.

a) $\frac{2}{8} =$ $\frac{\quad}{16}$

b) $\frac{6}{10} =$ $\frac{\quad}{5}$

2 Fill in the missing numbers.

a) $\frac{3}{5}$ of 100 $\frac{\quad}{\quad}$ b) $\frac{8}{10}$ of 20 $\frac{\quad}{\quad}$ c) $\frac{5}{8}$ of 80 $\frac{\quad}{\quad}$

d) $\frac{2}{9}$ of 180 $\frac{\quad}{\quad}$ e) $\frac{3}{10}$ of 300 $\frac{\quad}{\quad}$ f) $\frac{6}{7}$ of 280 $\frac{\quad}{\quad}$

First seen: Book 2 Page 60

KS3 Catch-Up Maths — Workbook 3 © CGP — not to be photocopied

5
First seen: Book 2 Page 12

3 Do these written subtractions using the boxes given.

a) $351 - 164$ b) $728 - 589$ c) $546 - 278$

-

-

-

d) $914 - 857$ e) $865 - 398$ f) $621 - 259$

-

-

-

4 Work out these multiplications.

First seen: Book 3 Page 2

a) $3 \times 2 \times 8 =$ b) $6 \times 5 \times 8 =$

c) $7 \times 3 \times 10 =$ d) $10 \times 10 \times 3 =$

e) $5 \times 4 \times 11 =$ f) $5 \times 12 \times 8 =$

5 Fill in the blanks to show equivalent fractions.

a) $\frac{1}{3} = \frac{\quad}{6}$ b) $\frac{4}{5} = \frac{\quad}{10}$ c) $\frac{1}{4} = \frac{\quad}{8}$

d) $\frac{4}{8} = \frac{\quad}{2}$ e) $\frac{1}{2} = \frac{\quad}{14}$ f) $\frac{1}{3} = \frac{\quad}{12}$

g) $\frac{2}{4} = \frac{\quad}{16}$ h) $\frac{2}{20} = \frac{\quad}{10}$ i) $\frac{6}{7} = \frac{\quad}{21}$

First seen: Book 2 Page 12

On the trail of more practice — turn to the next page...

© CGP — not to be photocopied KS3 Catch-Up Maths — Workbook 3

Topics interleaved with spaced practice



What else impacts on ability to learn maths?

- self-belief
- low attendance
- poor teaching
- behavioural / attention problems
- poor working memory
- high anxiety
- fixed mindset

High Anxiety Items

- Taking an end of term maths exam
- Doing long division questions without a calculator
- Waiting to hear your score on a maths test
- Having to work out answers to maths questions quickly
- Learning the hard times table facts

(Steve Chinn 2009)

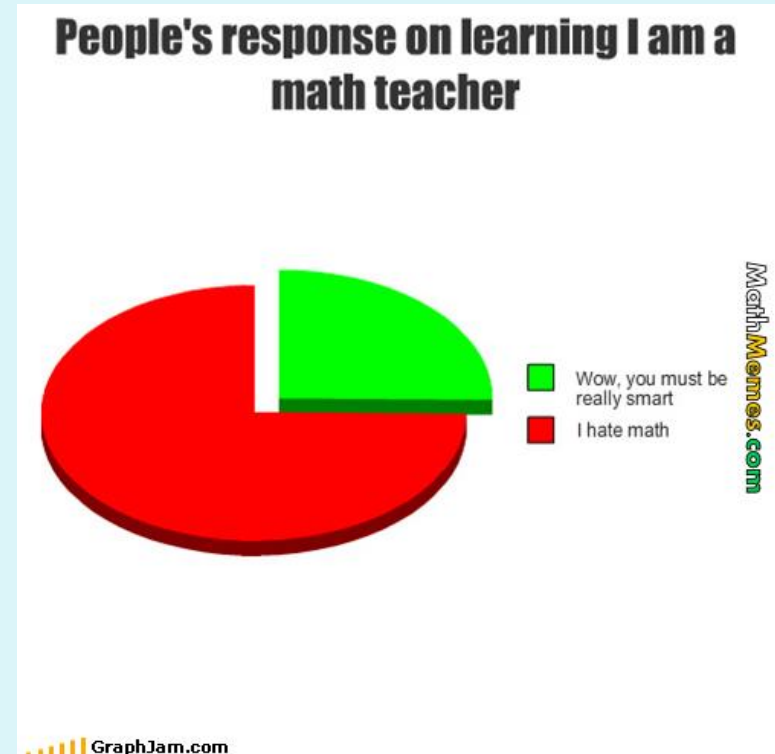


Why do children lose confidence?

Idea that you must be naturally talented at maths in order to succeed...

Idea that maths is too hard...

Idea that there is only one right answer...



Mistakes are a good thing



There is no such thing as a "maths person" – everyone has the potential to learn maths to the highest levels.

This is how we grow our "maths brain." When we learn, one of three things happen:

- 1) We grow a new brain pathway;**
- 2) A brain pathway becomes stronger; or**
- 3) Different brain pathways connect.**

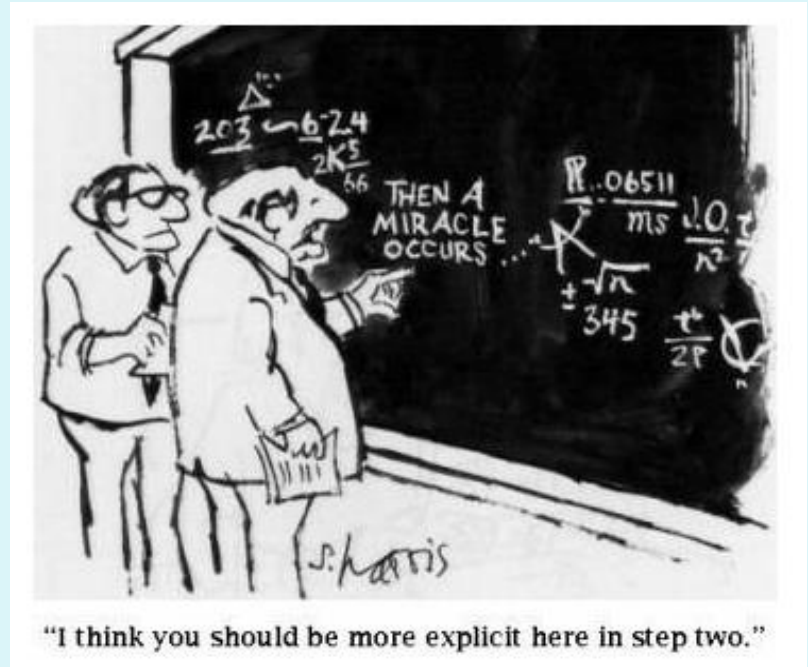
— Jo Boaler

<https://www.youtube.com/watch?v=3ZyVBwnScJw>

Jo Boaler – youcubed.org

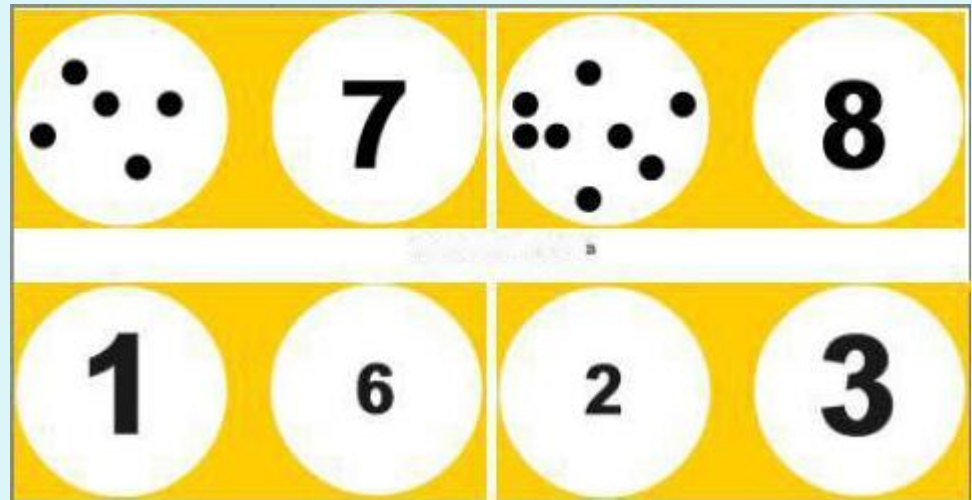
Assessment

- How severe is the problem?
- What can't he do?
- What can he do?
- What doesn't he know?
- What does he know?
- How does he learn?
- How can I teach him?
- What does the learner bring?
- Where do I start the intervention?

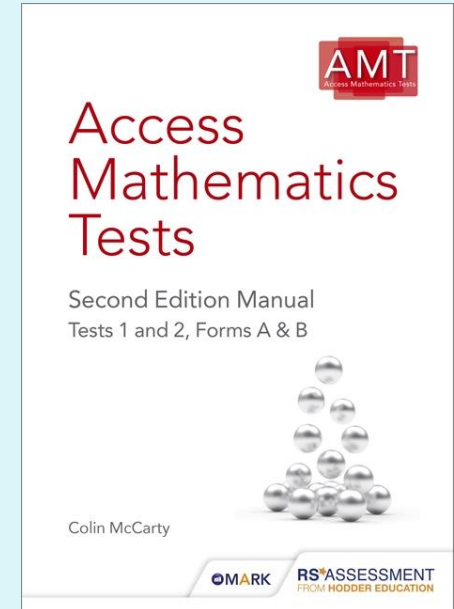
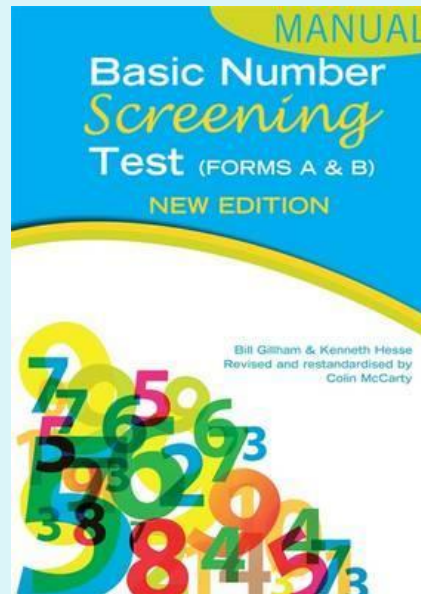


Identification – screeners

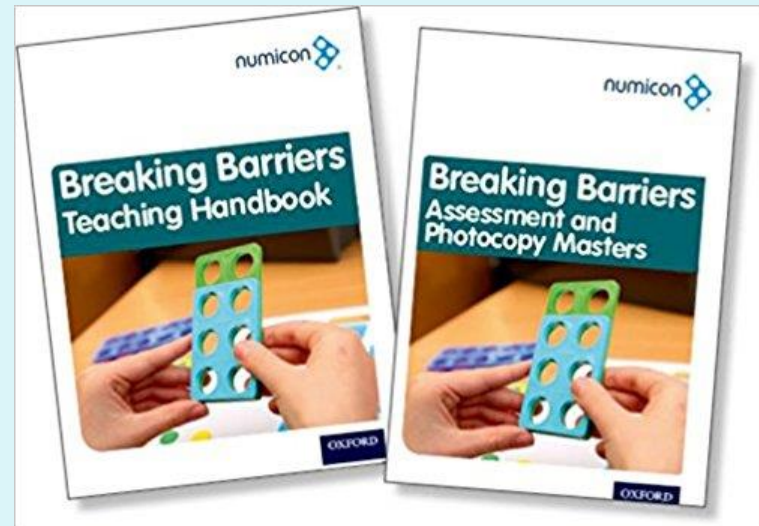
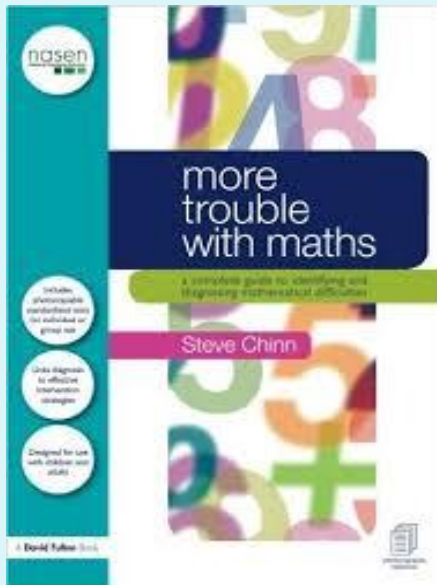
- Screeners (GL Dyscalculia screener) - show strengths and weaknesses in different strands of maths **BUT** screeners don't diagnose



Identification – tests



Identification

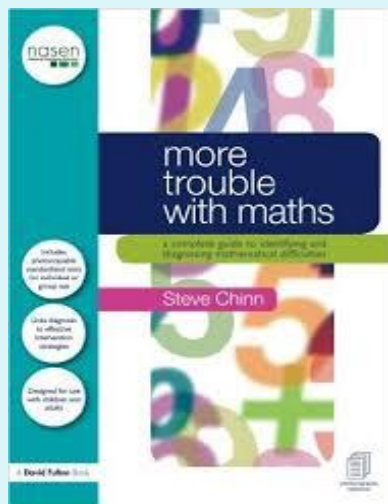


Catch Up[®] Numeracy



Identification

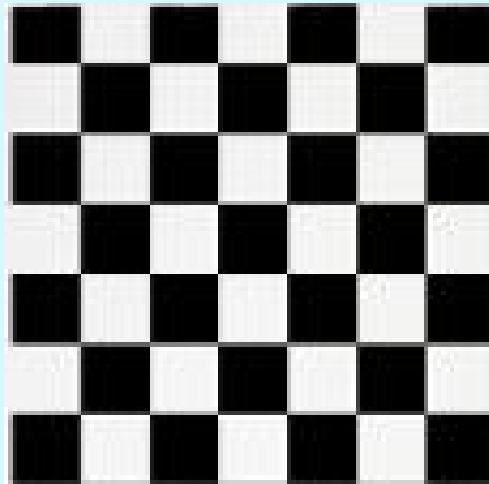
- **Checklist** - Steve Chinn, More Trouble with Maths 2016. Importance of **observation** and **discussion**.



- Dyscalculia checklist
- Observation sheet
- Short term & working memory test
- Basic facts tests
- Maths anxiety assessment
- 15 minute maths test
- Test of cognitive style
- Word problems

Does teaching style influence thinking style?

8
6
3
4
7
2
+6

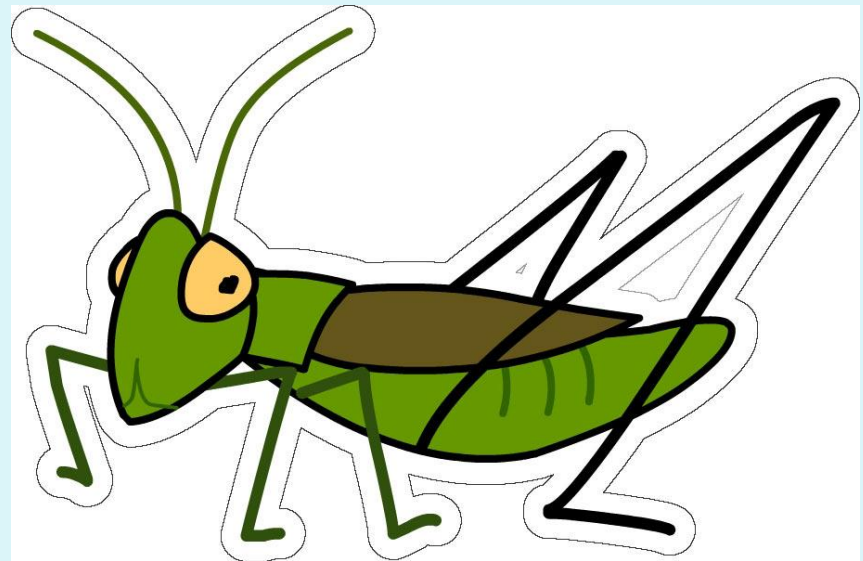


A film starts at 7.40 pm and ends 1 hour 50 minutes later.

At what time does the film finish?

There are 49 squares in this figure.
How many are black?

Thinking (cognitive) styles



Inchworm

– the formula, sequential thinker



On first seeing the problem or task:

- Focuses on parts and details
- Looks the relevant formula or procedure
- Constrained focus – one method

Solving the problem:

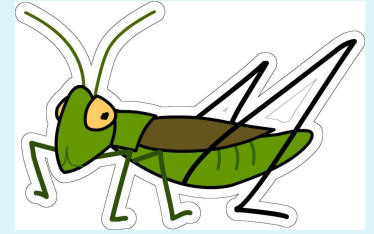
- Works in serially ordered steps– forward
- Uses numbers exactly is given
- More comfortable with paper and pen to document methods

When finished:

- Unlikely to check or evaluate answers
- Any check done uses the same method again
- May not understand method/procedure – work mechanically

Grasshopper

– the relational, holistic thinker



On first seeing the problem or task:

- Overviews, puts together, is holistic
- Looks at numbers and facts to estimate answer

Solving the problem:

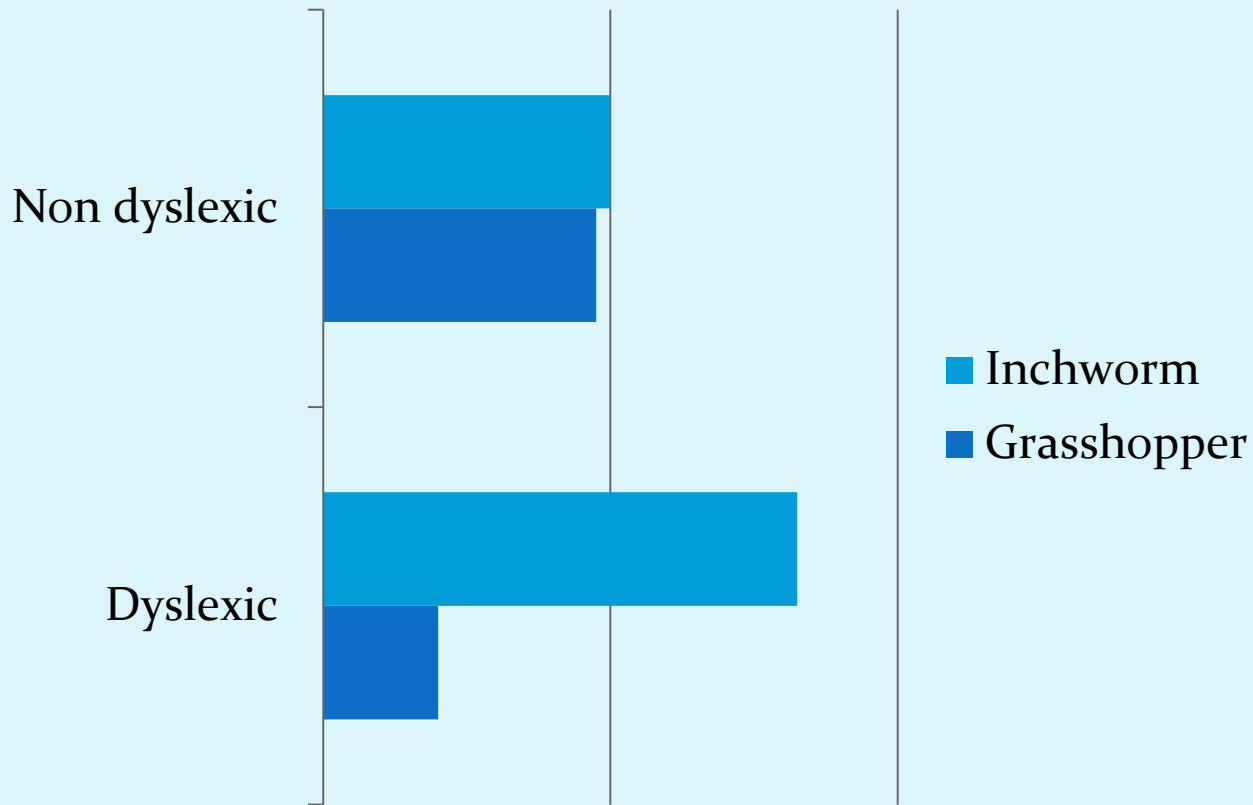
- Range of methods selected according to problem
- Often works back from trial answer
- Adjusts, breaks down and builds up numbers looking for easy number combinations
- Good understanding of numbers, operations and their interrelationships
- Performs calculations mentally and rarely documents – answer oriented

When finished:

- Likely to appraise and evaluate the answer
- Checks by different method

Cognitive Style

Dyslexic vs Non-dyslexic (England)



$$4 + 13$$

Strategies for solving $4 + 13$

- Counting all
- Counting on
- Known facts
- Derived facts

Strategies for solving $4 + 13$

above average

- Counting on 9%
- Known facts 30%
- Number sense 61%

below average

- Counting all 22%
- Counting on 72%
- Known facts 6%

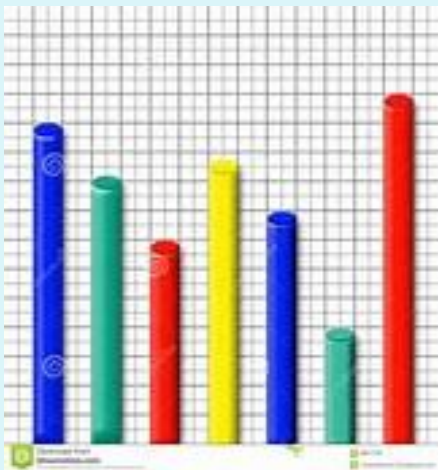
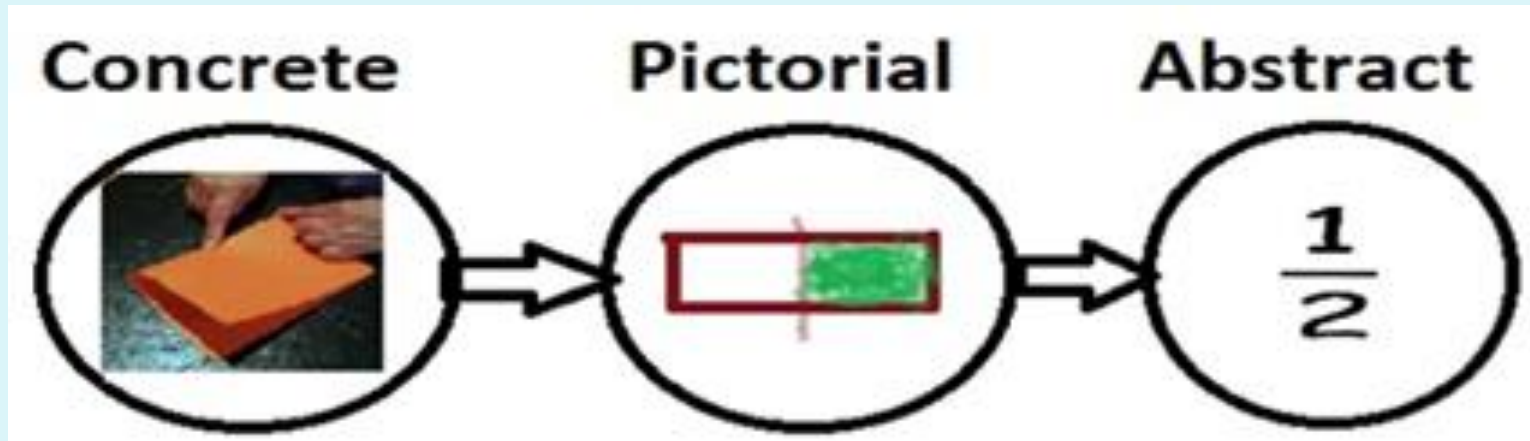
Helping children develop maths fluency

- Focus on mathematical understanding rather than rote memorisation
- Shift to enquiry based maths (rather than right answer)
- Spend time where it's needed to develop deeper understanding
- Make it visual
- Number talks – make connections
- Collaborative learning – mixed ability groups
- Power of mistakes
- Enjoyment - maths without fear
- Importance of student's beliefs in themselves as a learner



Jo Boaler – youcubed.org

Active learners...



A multisensory teaching approach works best
for dyslexic students

Hands on

Switches

Brains on

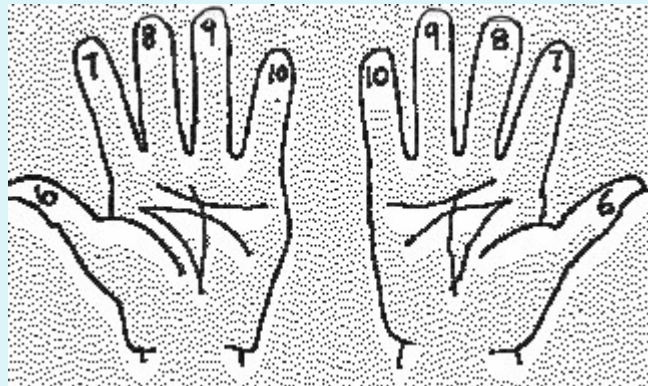
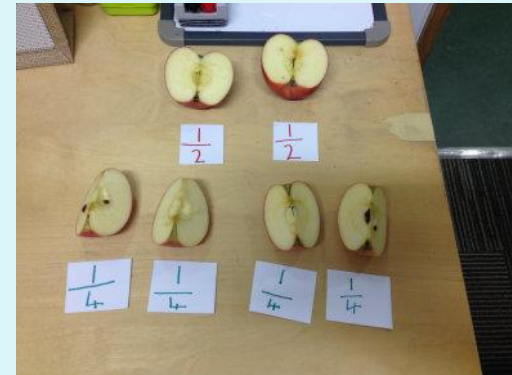
‘Keep it Kinaesthetic’

(Neil MacKay 2003)



Dyslexia Outreach
SERVICE

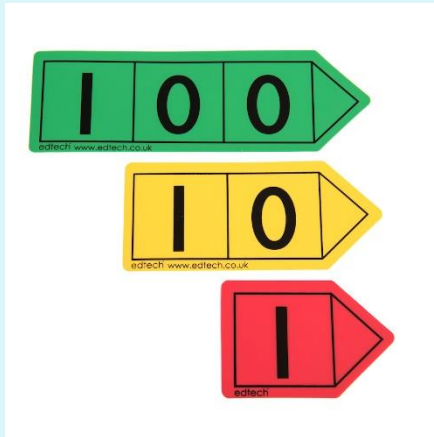
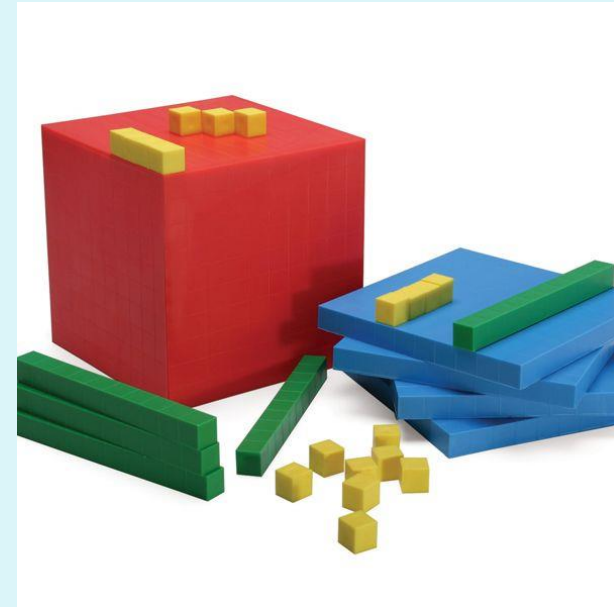
Multisensory



The way forward...

- Allow free play. Let children discover the properties of the manipulatives themselves.
- Provide access to a wide variety of manipulatives and choice
- Make manipulatives readily available to KS3 & beyond if required
- Encourage children to demonstrate a specific idea using their chosen manipulative
- Encourage children to generalise
- Children show you and each other different ways of solving a problem using a variety of materials

Place value



0-01	0-02	0-03	0-04	0-05	0-06	0-07	0-08	0-09
0-1	0-2	0-3	0-4	0-5	0-6	0-7	0-8	0-9
1	2	3	4	5	6	7	8	9
10	20	30	40	50	60	70	80	90
100	200	300	400	500	600	700	800	900
1000	2000	3000	4000	5000	6000	7000	8000	9000
10000	20000	30000	40000	50000	60000	70000	80000	90000

TTh	Th	H	T	U	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
				4	7	2	5

Times Tables - add some music!



Youtube –Mr DeMaio

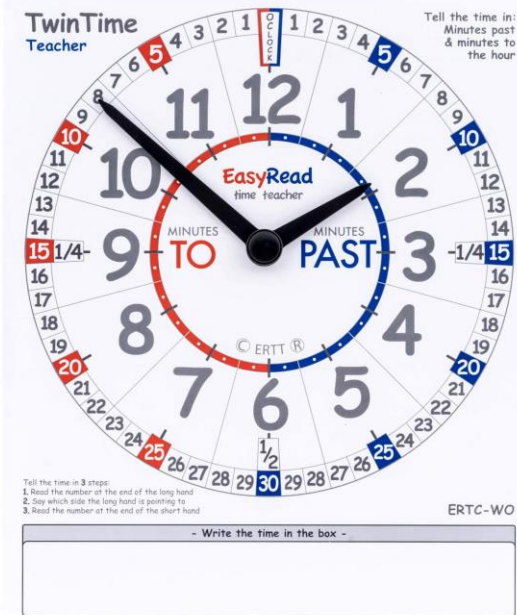
<https://www.youtube.com/watch?v=gXzfQUqiYY>

- Maths Rockx <http://www.mathsrockx.com>
- Times Tables Rock Stars <https://ttrackstars.com/>
- Schoolhouse rock
<https://www.youtube.com/watch?v=zSRRAHvSQBo>

Technology Packages for Practice

- Dyslexia Gold – Times Table Tutor
<https://timestabletutor.co.uk/>
- Times Table Rock Stars
- Hit the Button <https://www.topmarks.co.uk/maths-games/hit-the-button> (PC free, app £2.99)
- Tables Fables (parents?) <https://www.tablefables.net/>
- Mathematics Shed
<http://www.mathematicshed.com/multiplication-shed.html>

Time



Learning Time in 3 Simple Steps

- Step 1:** Read the numeral at the end of the long hand
- Step 2:** Say 'past' if the minute hand is on the green or blue OR say 'to' if it is on the pink or red
- Step 3:** Read the numeral the short hand is pointing to



"16 minutes past 2"
It's that simple!

EasyRead
time teacher

Diameter 33mm

Glass face

Water resistant

5+ years

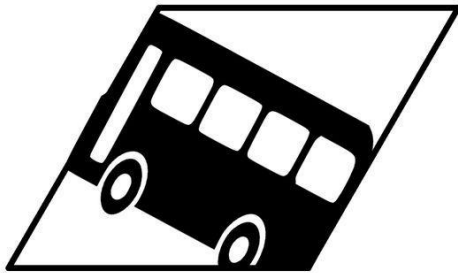
<http://sweetelephants.com.au>



Angle machine manipulative

Challenge of maths language

HE TOOK
THE RHOMBUS.



Word definition graphic organiser

Key words	Never heard the word before	Heard it but not sure of its meaning	Know what it means and can explain in context – jot down your ideas here
exponent			
greater than/ equal to			
less than/ equal to			
significant figures			
decimals			
upper bound			
lower bound			
integers			
power*			
roots*			

third space learning

Ultimate Maths Vocabulary Activity Guide

Maths Vocabulary Activities And Tasks

The Ultimate Maths Vocabulary Activity Guide

Why is developing Maths vocabulary so important?

Language is essential to the development of literacy and mathematical skills at KS1 and KS2. Without a firm grasp on the vocabulary surrounding the subject of Mathematics, they are unlikely to become engaged and achieving as young learners.

What are the key skills in developing Maths vocabulary?

We can expect children's use of language to vary into problems, but it is worth paying attention to whether they are forming, using, and applying the following key features of language development as part of their maths activities.

Types of talking pupils should be doing during Maths activities

- Explaining - giving a clear and detailed account
- Describing - giving observations and experiences into words
- Categorising - classifying according to common characteristics
- Making connections - between sets of information
- Interpreting - perceiving the signals and/or communications
- Predicting - using available information to estimate outcomes
- Comparing - showing similarities and differences between items and relationships
- Concluding - valuing differences between items or relationships
- Clarifying - making clear their understanding
- Justifying - providing evidence to prove a point
- Elaborating - developing and extending ideas
- Planning - organising ideas, stating aims of reasoning
- Asking more questions - children ask their own questions and present issues
- Investigating - exploring systematically in order to solve a problem
- Evaluating - judging and assessing
- Arguing and leading a case - presenting supporting reasons in a statement
- Reasoning - drawing conclusions from facts and evidence
- Hypothesising - suggesting an explanation for a group of facts
- Reaching a conclusion or sharing about
- Reasoning - sharing personal experience and feelings
- Summarising - providing a brief account of the main points

The more the resources and the more support the more the

The Ultimate Maths Vocabulary Activity Guide

Maths Vocabulary Games, Activities and Ideas

KS1 / KS2

Ultimate Maths Vocabulary Activity Guide

Graphic organisers: A method to improve word definition knowledge

Graphic organisers are a methodical way of stimulating children's understanding of Maths. As defined as a graphic organiser, word definition activities help children understand and express their understanding of words and their meanings. They help children think in depth about Maths vocabulary, as defining a word collaboratively before someone is asked and discuss their ideas in order to reach a shared understanding. The clarity, precision and complexity of the definitions give us a clear signal that children know, don't know and partly know. This provides valuable diagnostic feedback which we can build on to create further more accurate definitions. If definitions can be used across the Maths curriculum but it is helpful to focus on a few themes or areas.

As a primary to Secondary children's own comprehension of the words that they will read with. Different learners will have diverse definitions and will express them in different ways.

If definitions are primarily useful at the commencement and conclusion of a piece of work, then any children can take any changes to the definitions and can discuss how their understanding of the word has improved, the precision, accuracy and clarity of the definition give a good clue of the level of understanding.

Here's how it works

I present the children with a partially completed word definition table (see below) if word, you can add a couple of definitions, either accurate or not, to get children started, a children are certain they understand a word, then they can give it three stars (but I can explain they can only use the 'three stars or better' definition table) which they can present the table at 100%.

No	What we think it means:	How far it fits us?
1		<input type="checkbox"/> - I really like it <input type="checkbox"/> - I like this a bit <input type="checkbox"/> - I don't like it
2		
3		
4		
5		

The more the resources and the more support the more the



... and challenges of symbols

Math Boxes 1.6

1. Write < or >.

a. 0.5 or 1.0

b. 3.2 or 3.02

c. 4.83 or 4.8

d. 6.25 or 6.4

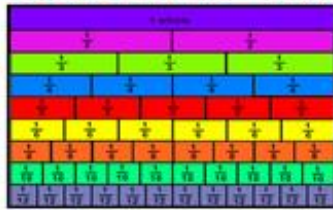
e. 0.7 or 0.07

2.

Names: _____

Maths Mat

An acute angle is an angle whose measure is less than 90°	
A right angle is an angle whose measure is 90°	
An obtuse angle is an angle whose measure is more than 90°, but less than 180°	
A straight angle is an angle whose measure is 180°	
A reflex angle is an angle whose measure is more than 180°	



x	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

Percent	Decimal	Fraction
1%	0.01	$\frac{1}{100}$
5%	0.05	$\frac{1}{20}$
10%	0.1	$\frac{1}{10}$
12.5 or 12 1/2 %	0.125	$\frac{1}{8}$
20%	0.2	$\frac{1}{5}$
25%	0.25	$\frac{1}{4}$
33.3 or 33 1/3 %	0.33...	$\frac{1}{3}$
50%	0.5	$\frac{1}{2}$
75%	0.75	$\frac{3}{4}$
80%	0.8	$\frac{4}{5}$
90%	0.9	$\frac{9}{10}$
99%	0.99	$\frac{99}{100}$
100%	1.00	$\frac{100}{100}$

HM	TM	M	HTH	TTH	TH	H	T	U	th
<small>Hundred of Millions</small>	<small>Tens of Millions</small>	<small>Millions</small>	<small>Hundred of Thousands</small>	<small>Tens of Thousands</small>	<small>Thousands</small>	<small>Hundreds</small>	<small>Tens</small>	<small>Units</small>	<small>Tenths</small>

Mega Maths Mat

10	100	1,000	10,000	100,000	1,000,000	10,000,000	100,000,000	1,000,000,000
Billions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Units	Decimal Point	Tenths
10	100	1,000	10,000	100,000	1,000,000	10,000,000	100,000,000	1,000,000,000
11	12	13	14	15	16	17	18	19
21	22	23	24	25	26	27	28	29
31	32	33	34	35	36	37	38	39
41	42	43	44	45	46	47	48	49
51	52	53	54	55	56	57	58	59
61	62	63	64	65	66	67	68	69
71	72	73	74	75	76	77	78	79
81	82	83	84	85	86	87	88	89
91	92	93	94	95	96	97	98	99

Number Square

Addition

300 + 100 = 400
more + less = total sum
combine altogether

Subtraction

500 - 200 = 300
take minus = left over
take away = difference

Multiplication

3 x 4 = 12
multiply times or product of groups of = times number = product

Division

12 ÷ 3 = 4
share = share equally or separate into groups of = equal = quotient

is greater than is less than

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

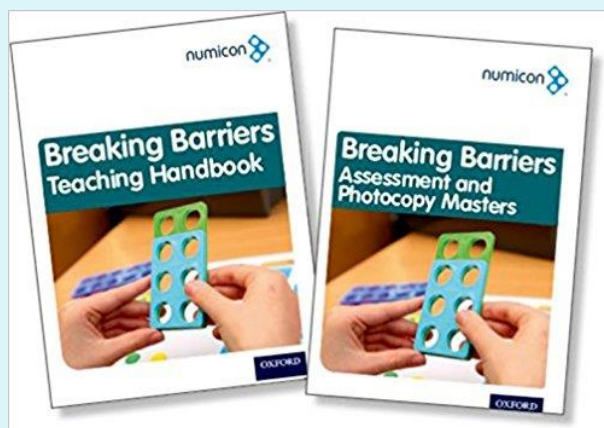
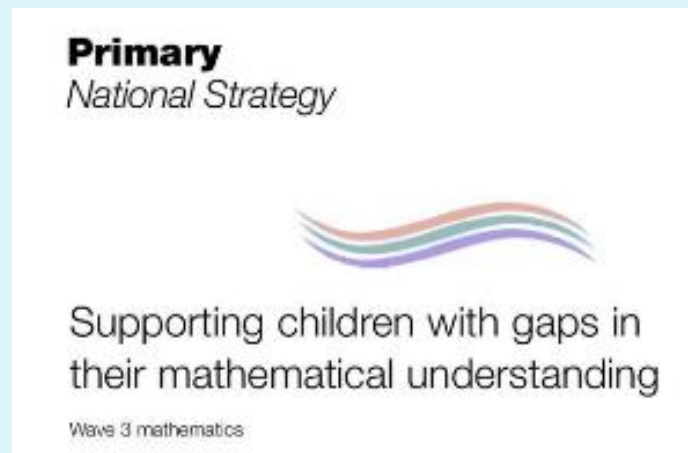
Multiplication Square

$\frac{3}{4}$
3 ← Numerator (top number) = how many parts? (how many pieces?)
4 ← Denominator (bottom number) = how many parts in the whole? (how many pieces?)

Fraction	Decimal	Percentage
$\frac{1}{10}$	0.1	10%
$\frac{1}{5}$	0.2	20%
$\frac{1}{2}$	0.5	50%
$\frac{3}{4}$	0.75	75%

Fractions

Intervention resources



Free Maths Games & Resources



Resources:

Wave 3 Materials: Supporting Children with Gaps in their Mathematical Understanding

<http://www.nationalstemcentre.org.uk/elibrary/maths/resource/4558/wave-3-materials-supporting-children-with-gaps-in-their-mathematical-understanding>

Steve Chinn: Dyscalculia & Maths Learning Difficulties

<http://www.stevechinn.co.uk/>

Making Numbers – Oxford Professional Development – Griffiths et al

Supported by animations and free author videos on www.oxfordowl.co.uk

Making Maths Visual & Tactile – Judy Hornigold