Maths Matters:
Maths and Dyslexia, an introduction to dyscalculia

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What is Dyslexia?

- Dyslexia is evident when accurate and fluent reading and/or spelling develop very incompletely or with great difficulty. This may be accompanied by a difficulty with numeracy.

Memory and Organisation

- Remembering -alphabet -tables
- Copying correctly
- Forgetting instructions
- Remembering formulae
- Coping with time
- Learning it one day – then….

Family History and Developmental background

- Dyslexia is hereditary
- Delay of early development
- Usually blood relatives with difficulties
- Some birth difficulties
- Co-morbidity with dyspraxia, dyscalculia, dysgraphia
- Giftedness in many cases

Characteristics of Dyslexia

- Discrepancy -intelligence and attainment
- Good and bad days
- A spiky profile
- Problems
- Disorganized
- Poor results

Other Dyslexia Difficulties

- Reading
- Spelling
- Writing
- Sentence structure
- Sequences
- Avoidance strategies

Visual Difficulties

- Eye tiredness
- Letters - move
- Glaring white spaces
- Skipping words

- Scotopic sensitivity syndrome

Behaviour and Emotion

- Reading aloud
- Tiredness - effort to achieve
- Low self - esteem
- Frustration
- Peer group rejection

Statistics

According to current estimates
(Butterworth (1999))

- about 10% of the population are dyslexic (4% severe, 6% mild/moderate)
- of these 40% have some degree of difficulty with maths
- additionally 4 to 6% is dyscalculic only.

Dyscalculia (Kosc)

Various forms. A person may have some or all of these characteristics as for dyslexia:

Verbal	(interpretation of terms)
Operational	(performing operations)
Lexical	(written terms, symbols)
Graphical	(symbol manipulation)
Ideognostic	(mental calculations)
Practognostic	(pictorial representation)

Types of mathematical deficits (Luria)

- Deficits of logic: problems with spatial order e.g. 'the circle below the square', or writing numbers in correct sequence
- Deficits in planning: developing problem solving strategies - understanding the maths language.
- Perseveration: inflexibility in application e.g. continuing to divide by 2, a strategy which has been successful
- Inability to do simple calculations: e.g. use of multiplication tables, inefficient counting or addition strategies.

More precise specification (Mahesh Sharma)

"Dyscalculia is an inability to conceptualise numbers, number relationships (arithmetical facts) and the outcomes of numerical operations (estimating the answer to numerical problems before actually calculating)."

The emphasis here being on conceptualisation rather than on the numerical operations

The National Numeracy Strategy of UK
The DfES (2001)

" 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."

Definition of Dyscalculia (Butterworth 2002)

- Dyscalculia is sometimes called number blindness. It is the name given to the condition that affects our 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.

- 6% difficulties with calculation - higher than 4% with reading difficulties.

Thomas West (In the Mind's Eye)

  - For Dyslexics 'hard' things can be easy and 'easy' things can be hard
  - Paradoxically in school before achieving 'hard' things you must be good with 'easy' things
- Some dyslexics -leap forward with certain concepts, without systematically going through all the 'proper' steps
- Older students concentrate on areas of strength

Students may have problems with all or some of these:

- Language of mathematics
- Visual, direction, sequencing
- Organization
- Memory
- Poor short-term memory
- Filing system in long-term memory

Maths Checklist can they:

- say times tables correctly?
- do simple computation?
- say what the symbols mean?
- identify shapes?
- count forwards and backwards?
- copy numbers correctly?
- say the days of the week, months in order?
- tell the time? use money?

- read and write numbers?
- do mental calculations? work out sequences?

(Table 2)

Development of skills & computation

- Estimation
- Remembering number facts
- Use learnt facts to work out new problems
- Able to predict answers
- Able to evaluate answers & know if reasonable
- Understand & use relationship between 4 rules
- Use mental strategies to work out
- Use informal jottings

Problem Solving

- Development of thinking skills
- Making sense of problems
- Recognising operations
- Applying range of skills & strategies to compute both mentally and formally

Challenges mathematics presents for all pupils

- Numbers are abstract – mathematics is a symbolic language

- Mathematics uses familiar words in an unfamiliar context

- The commonly held view that children develop arithmetic understanding is often unhelpful

Bruner's forms of representation

- Enactive – internalised *action* e.g. riding a bicycle, writing by hand

- Iconic – sensory imagery e.g. bacon and eggs

- Symbolic – *arbitrary symbols* e.g. words (spoken and written), numerals, which bear only an arbitrary relation to what they 'stand for'.

Characteristics of Numicon teaching activities

- The tasks have a meaningful context
- The tasks are playful with appropriate level of challenge
- The tasks are multi-sensory – appeals to different learning styles
- The tasks are self-correcting
- There is interaction with others – peers and teachers which moves children on in their thinking.

Numicon helps with

- Numicon is designed for children to:
- Manipulate, observe, notice, explore patterns
- See connections between images
- See that numbers form a highly organised system – full of many kinds of patterns
- Form impressions, develop ideas, techniques, skills, associations & experiences that add up to mental impressions of maths ideas
- Develop *concept images* that play an important part of number experiences

Maths Display

- Current learning
- Interesting,exciting & visually attractive
- 2D & 3D images
- Children's work
- Display clean & clutter free
- Fresh & interesting –
  - colour, shape, number, counting

Pattern

- Need pattern recognition to make sense of the world
- Predict outcomes
- Visual patterns help make connections
- Number connections enable children to problem solve

Order

- Recognise order and internalise it
- Connect -1more and 1 less
- Images are systematic way of seeing order
- Ordered images on a number line can be stored in long term memory as a basis for connecting more advanced numbers

Counting

- First experience of number
- Complex
- Finding the number is important to determine size of set
- How many are there/
- Counting should not be underestimated

Moving beyond counting

- Need to see numbers as wholes
- Visual pattern of Numicon
- How each individual whole number relates to other whole numbers is important
- Organised wholes
- Need to know 'How many?' without counting

Place value

• Difficulty with written symbol 4 written four	• Conflict with similar sounding numbers 15 & 50	• Grouping in 10s • 10 ones • 10 tens etc
• Numbers 11,12, • Morphemes third & fifth obscure 3 & 5 meanings	• The number 30 • 1 less than 31 • 1 more than 29 • Also 3 x 10	• Is symbolic language for reading numbers
• Shorthand signalling- place within a number signifies a value	• Difficulty with writing numbers 203 recorded as 2003	• Partitioning numbers helps with place value

Addition & Subtraction

- **Addition**
- Add together
- Increase
- Together more
- **Subtraction**
- Take away
- Decrease
- Difference comparison

Numicon Activity cards

1. Getting to know patterns (1 & 2)
2. Putting the shapes in order (3)
3. Giving shapes number names(4)
4. Ordering shapes & numerals (5)
5. Knowing shapes & numerals(6 & 7)
6. Beginning place value(8)
7. Addition (9 & 10)
8. Subtraction (11 & 12)

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When planning …

- Think about what do children need to know in order to do the task

e.g. What do children need to know in order to use number facts of numbers 1-10 to add and subtract whole tens?

- Structure of numbers to 100
- Recognising numerals, reading place value
- Tens and units
- Accurate counting
- instant recall of number facts so working memory is clear to think about the problem to be solved

Teaching checklist

1. Explain activity to children (aim)
2. Use appropriate maths language
3. Check that children can see & hear
4. Work near the number line
5. Encourage children with praise
6. Reinforce the aim in plenary
7. Value everyone's contribution

Importance of Language and Mathematics

- Correct mathematical terms
- Group work -research (Askew & William)
  - range of ability
  - Techniques of 'snowballing' and 'jigsawing'
- Group discussions
- Active involvement by students in language is beneficial to their understanding. Vygotsky

Organisation

- Use 0.7 cm squares
- Use of margins
- Number of the calculation
- Use of rulers and columns
- Show the answer clearly

Direction

- Left and right
- Reinforce position words
- Where to begin

Perseveration

- Pre-empt the problem
- If the problem persists..
- Practice checking back

Always:

- Relate new concept to past learning
- Prepare translations
- Provide multisensory stimuli
- Work with the individual's learning styles
- Use mnemonics, mind maps, tapes
- Set targets for improvement one at a time
- Provide handouts with notes for older students
- Encourage sharing (buddy system)
- Mark for positive achievement

…be aware of A*voidance Techniques*

Summary

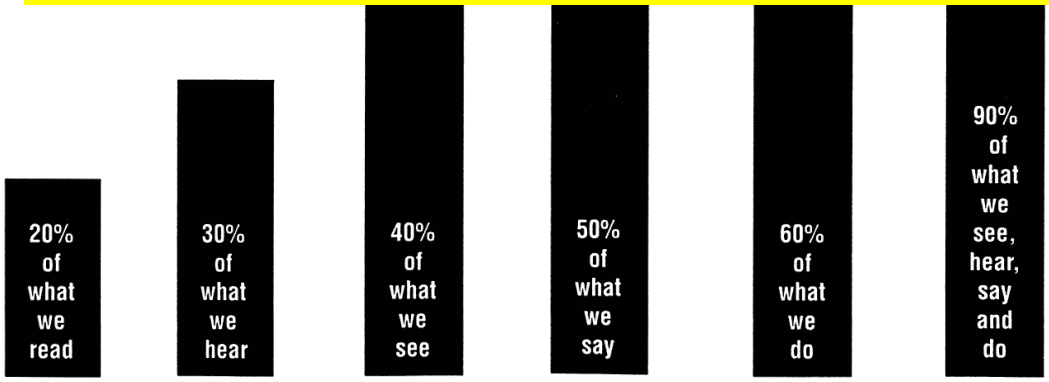
- West (1999) describes the dyslexic person as 'one who can see the unseen, understand patterns of incomplete information and comprehend the complex whole'.
- 'Specialists in many fields recognise the power of visual approaches. Dyslexia should be viewed as a difference not a deficit and strengths in visualisation should be utilised'.
- Words by the Waterboys,

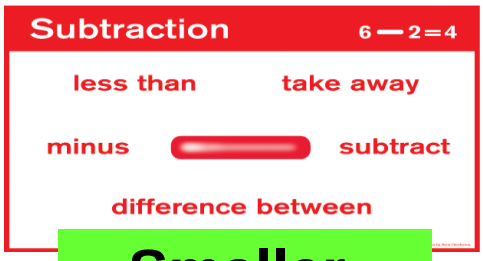
'I saw the crescent, but you saw the whole of the moon' may well refer to the processing style of dyslexics
(Reid & Kirk 2001).

On average we remember…

The more you can see it, hear it, say it and do it,

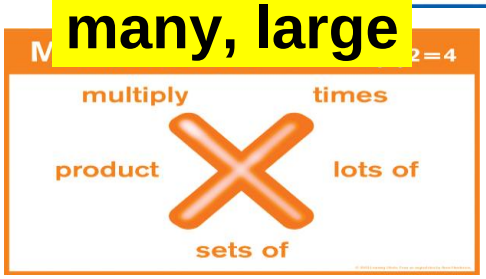
the easier it is to learn.

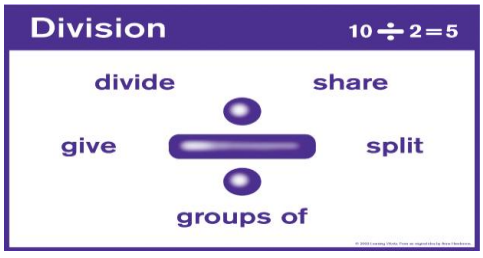




Bigger, more, greater, increase, many, large

Smaller, fewer, less, decrease,reduce, little





Maths Software

Smile for windows (1-9)	***Games & Puzzles***
Number Shark	***40 Games***
Mental maths Olympics	***Year 4 & 5***
Number Works	***Numeracy***
The Crystal Rain Forest	***Adventure Game***
Super market	***Money***
Sum One	***4 Rules***
Maths made Easy (1-5)	***Years 1-6***
Shape	***Levels 1-3 NC***
Maths Explorer	***Ks2***
Number	***Ks2***
Data handling	***Ks2***
Number	***Levels 1***
Maths Circus 1,2 &3	***Strategies***
Clockwise	***Teaching Time***
Amazing Maths	***Basics***
Maths in Motion	***Basics***