

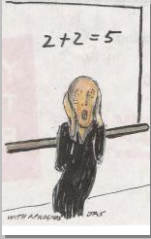
Slide 1

(31) Signs of dyscalculia

Lexicon, Dubai

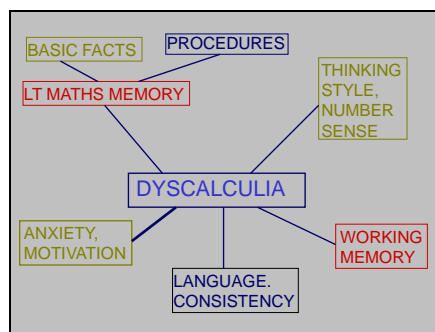
Steve Chinn

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A cartoon illustration of a person with a distressed expression looking at a blackboard. On the blackboard, the equation $2+2=5$ is written. The person is standing in front of the board, which is mounted on a wall.

Slide 2

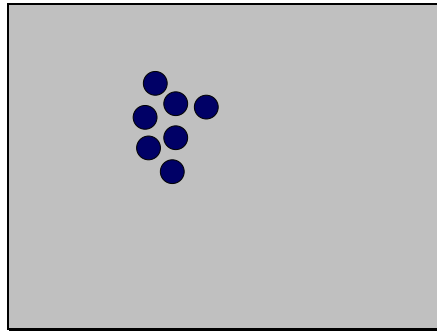


Slide 3

1. Finds it impossible to 'see' that four objects are 4 without counting (or 3 objects, if a young child)


- This skill is called 'subitizing' and is considered to be a key pre-requisite skill for numeracy (Brian Butterworth)

Slide 4



Slide 5

Butterworth's Screener

Dot enumeration (subitizing) 

- Number comparison (Numerical stroop)

4 6 5 3

Slide 6

2. Difficulty counting objects accurately and lacks the ability to make 'one to one correspondence'

- This can create an early insecurity with numbers and thus handicap the development of number sense.
- It all begins with counting

Slide 7

Counting

- There are three kinds of people in the world
- those who can count
- and those who can't

Slide 8

3. Finds it much harder to count backwards compared to forwards

- Partly to do with consistency, partly practice, partly an inherent problem with changing to reverse processes. Could be rooted in problems with working memory.
- This skill sets the foundation for subtraction
- The danger of making assumptions

Slide 9

4. Counts on for addition facts, eg, $6 + 3$, counting on 7, 8, 9 to get the answer

- Counting is a tempting strategy. It works. It is reasonably quick for the basic facts. The comfort zone.
- Counting in ones does not develop number relations, nor number sense, nor the skill of estimation.

Slide 10



Slide 11

Derived Facts

Gray and Tall, 1994. Univ Warwick

- 72 students aged 7 – 13 years... addition
- Above av: 9% counted on
- 30% known facts
- 61% derived facts
- Below av: 72% counted on
- 22% counted all
- 6% known facts
- 0% derived facts

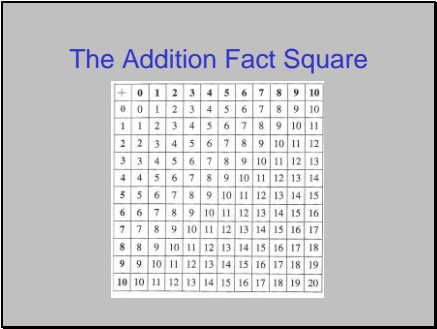
Slide 12

Visual images for counting

- Bead strings, number lines and base ten

The slide shows three visual representations for counting: a bead string with 10 beads (5 green, 5 red), a number line from 1 to 6, and a base ten block structure showing a 10x10 grid of orange blocks with some blocks missing to represent the number 64.

Slide 13



Slide 14

5. Difficulty with retrieving addition facts from memory

- There are many basic facts. A child with a reasonable memory may remember many of them and thus give the illusion of learning. Using strategies which link facts and the operations develops understanding when the numbers being used are 'comfortable.'

Slide 15

6. Counts all the numbers when adding, eg., for 5 + 3, counts 1, 2, 3, 4, 5 6, 7, 8

- This behaviour shows a severe dependence on one-to-one counting. The learner cannot even use or see the first number as a quantity.
- (Counting on the bigger number, as in adding 9 to 4 when given 4 + 9 is not good developmentally)

Slide 16

7. Finds it difficult to count fluently sequences that are less familiar , such as: 1, 3, 5, 7...or 14, 24, 34...

- This skill demonstrates emerging number sense and the ability to see 'new' patterns. Place value.

Slide 17

8. Uses tally marks for addition or subtraction problems

- This suggests, again, a problem with moving on from counting in ones. The learner is not dealing with number as quantities (or chunking)
- As the numbers get bigger, counting in ones becomes increasingly inefficient. Developmental maths.


Slide 18

9. Difficulty in progressing from the materials and images (counters, blocks, tallies) to the symbols/numbers

- This is a problem with cognitive development (as identified by Piaget).
- There are also factors involving the vocabulary and place value

Slide 19

Manipulatives/materials
Multisensory learning



Slide 20

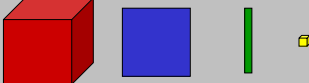
Materials. Hart 1989
'Sums are Sums and Bricks are Bricks'

- When asked for the connection between practical work and the symbolic statement of a rule, the children's best reply was that one was a quicker route to the answer than the other.
- Teacher teach, materials do not teach

Slide 21

Base Ten

- Blocks (Base 10/Dienes) work well as a visual image of whole numbers 1 to 1000:

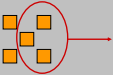


• one thousand	one hundred	ten	one
• 1000	100	10	1



Slide 22

Materials and language

- 5 'take away' 3



What is the difference?



5 3

Slide 23

10. Has poor skills with money, for example, unable to calculate change from a purchase

- Again, a life skill, but a cognitive variation on 'school' methods.
- People need the ability to select and use the maths relevant to the task.
- Money is not proportional (in size) to its value

Slide 24

11. Thinks an item priced at £4.99 is '£4 and a bit' rather than almost £5

- Another example of evaluating numbers literally rather than demonstrating number sense.
- This is also a 'real life' skill, helping with estimation and comparisons.
- It's about base ten (and decimals)

Slide 25

12. 'Sees' numbers literally and not inter-related, eg, counts up from 1 to get 9, rather than using 10-1.

- Again there is an over-reliance on counting rather than understanding numbers, their values and the operations that manipulate them.



Slide 26

13. Finds it difficult to write numbers which have zeros within them, such as, 'three hundred and four' or 'four thousand and twenty one'

- Zero, 0, is a key concept in place value.
- Place value is a key concept in learning maths
- Learners need to know 'Why base 10?' and the implications
- 300600050 6350

Slide 27

14. Finds estimating impossible

- First issue: If maths is taught as 'right' or 'wrong', a matter of being precise, then it should not be surprising that children do not adapt to the processes of estimation.
- Second issue: some learners are only comfortable when things are literal, especially those with insecure number sense.

Slide 28

15. Finds it difficult to judge whether an answer is right, or nearly right

- This is related to number sense and estimation skills.
- Checking by a different method is not a natural skill for all learners.
- The learner's emphasis is on process, not on outcome.
- It is rooted back to very early experiences of numbers

Slide 29

16. Organises written work poorly, for example does not line up columns of numbers properly

- This could be a consequence of comorbid dyspraxia.
- Lining up columns of numbers, setting out traditional 'long' multiplication are highly dependent on this skill

Slide 30

17. Does not 'see' automatically that $7 + 5$ is the same as $5 + 7$ (or that 7×3 is the same as 3×7)

- This property of numbers is called 'commutativity'
- It is useful in itself in working out additions such as $3 + 9$
- But it also halves the number of basic facts that need to be learned (works for multiplication facts, too) **Materials**

Slide 31

18. Writes 51 for fifteen or 61 for sixteen (and the same 'reversal' for all the teen numbers)

- This is a classic example of the inconsistencies of early work on numbers. It is a quirk of the English language for numbers.
- It can also expose a problem with dual tasking (and automaticity)

Slide 32

First learning experiences

- What we learn when we meet a new topic is a dominant entry to our brain.
- Buswell and Judd 1925
- 'Take the little number from the big number'

Slide 33

19. Forgets the question asked in mental arithmetic

- Short-term memory is a key skill for all learning. Children with learning difficulties often have very poor short-term memories. They may only be able to hold 2 or 3 items/facts in their memory.
- Repeat all and then the first. Chunk.

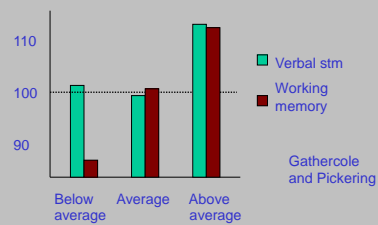
Slide 34

20. Struggles with mental arithmetic

- One of the key skills needed to be good at mental arithmetic is working memory
- Expectations are often that answers will be achieved quickly.... Speed and processing
- Anxiety depresses working memory

Slide 35

STM, working memory and maths in 6 and 7 year olds



Slide 36

21. Able to learn multiplication facts, but then forgets them overnight

- There is a wide spread expectation that all children can rote learn the times table facts. This is not so.
- Many children struggle to learn facts at night and then those facts have disappeared from memory the next morning... frustrating and demotivating.

Slide 37

Obituary for 88 year old teacher

TES. 04/06/2010

- He was the epitome of the village school master; he believed in times tables and the power of education.
- He was particularly keen on mental arithmetic, and demanded that his charges recite their times tables everyday.
- The illusion of learning.

Slide 38

Expectations

- From a maths book....'Further Activities: Things to do at Home'
- TABLES: Choose a multiplication table that is problematic
- and learn it!
- Learn to say it backwards too.
- From the TES, Feb 2006....Year 3 pupils will be expected to learn the 3x and 4x tables (*it was Year 4*) 'It is not about drilling children in their tables, but at some stage children do need to know them.'

Slide 39

Self-voice echo

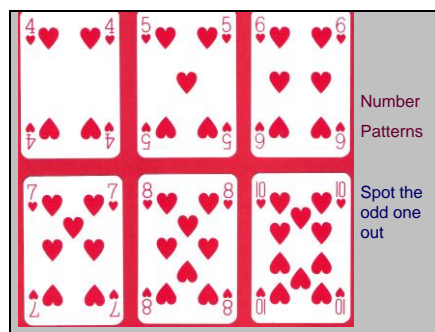
- One of the most effective strategies for rote learning is self-voice echo (Dr Colin Lane)
- Even this technique does not work for everyone (Lane and Chinn, 1986)
- 'Nothing works for everyone' The need to be flexible.

Slide 40

22. Only knows the 2x, 5x and 10x multiplication facts

- Soooo often the case!!
- Patterns and verbal clues make these facts more memorable
- But you can learn how to use them to build all the other facts... and learn about key maths procedures, too

Slide 41



Slide 42

23. Counts on to access the 2x and 5x facts

- Counting is still present as a base skill
- Show the patterns to take the learner towards automaticity

Slide 43

24. Makes 'big' errors for multiplication facts, such as $6 \times 7 = 67$ or $6 \times 7 = 13$

- This tends to happen with the low achievers. It demonstrates a lack of number sense.
- Higher achievers give a close, but incorrect table fact, or a near correct value answer.

Slide 44

Research and Education. 1.

'How People Learn' (2000) National Research Council, USA

- Key Finding 2 (out of 3)
- To develop confidence in an area of inquiry, students must,
- have a deep foundation of factual knowledge
- understand facts and ideas in the context of a conceptual framework
- organise knowledge in ways that facilitate retrieval and application.

Slide 45

Research and Education. 2 'Visible Learning' Hattie, 2009

- 'The highest effects accrued when teachers provided feedback data or recommendations to students.'
- **'The programmes with greatest effect were strategy based methods'**
- Least effective were using technology for independent practice, and the strategy of working within a peer group

Slide 46



Slide 47

25. Likes to use formulas, but uses them mechanically without any understanding of how they work

- This is a tempting situation for teacher and learners alike. Formulas are secure, but only if you remember them.
- Understanding maths begins at the earliest stages. It cannot be introduced effectively later without going back to the start.

Slide 48

26. Forgets mathematical procedures, especially as they become more complex, such as decomposing or borrowing for subtraction and, almost certainly, the 'traditional' method for division.

- Learning without understanding will result in forgetting what is learned

Slide 49

27. Gets very anxious about doing any maths

- 'Maths anxiety' is recognised as a problem internationally.
- In my research into anxiety in 11-17 year old students, taking a maths exam came top of the list with 'doing long division without a calculator' and 'having to do maths quickly' also high up the list.

Slide 50

Everyone loves fractions



Slide 51

28. Refuses to try any maths, especially unfamiliar topics

- Maths is usually a matter of right or wrong, success or failure.
- 'Never mind, you did your best'
- The 'no answer' error
- What motivates? What de-motivates?
- And at what age?

Slide 52

29. Becomes impulsive when doing maths, rather than being analytical.
Rushes to get it over with?

- A sign of inability and a type of avoidance.
- Also could be an extreme version of 'procedural/inchworm'

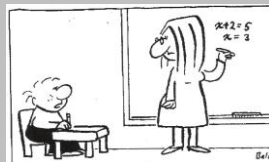
Slide 53

30. An inability to 'see' patterns or generalisations, especially ones that are incompatible with previous patterns, for example that $1/2$, $1/3$, $1/4$, $1/5$ is a sequence that is getting smaller.

- Patterns and generalisations support memory and understanding.
- Patterns that challenge previous consistencies need extra explanation

Slide 54

Consistency brings security



"Just a darn minute! Yesterday you said that x equals two!"

Slide 55

31. Thinks that algebra is impossible to understand

- If the principles of number and the operations are not understood, then algebra will not be understood.
- Intervention is about going back to where the learner is secure.
- $7 + 8 = \square$ $7 + \square = 15$

Slide 56

Effective Teaching

- Empathetic classroom management
- Responsive flexibility
- Methods that are mathematically developmental
- Effective communication

Slide 57

Parents helping children

- When new methods are introduced into maths, parents may become maths disabled, especially if they never understood what they were doing when they learned maths ... a self-perpetuating situation.

Tom Lehrer [1_My Documents\Tom Lehrer...New Math2.wmv](#)

Slide 58

In conclusion...

- Dyscalculia is a complex problem
- There is unlikely to be just one cause
- There is unlikely to be just one solution or teaching scheme
- Teaching needs to be diagnostic

[illegible]