Dyscalculia in Further and Higher Education

Presentation

- Definitions and Prevalence
- Screening
- Supporting Students

Towards a Definition

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DSM-IV (2000)

Mathematics Disorder:

"as measured by a standardised test that is given individually, the person's **mathematical ability** is **substantially less than would be expected** from the person's age, intelligence and education. This deficiency materially **impedes academic achievement or daily living**"

Key Features (1)

1. Mathematical level compared to expectation

"Most dyscalculic learners will have cognitive and language abilities in the normal range, and may excel in non-mathematical subjects" Butterworth (2001)

2. Impedance of academic achievement and daily living

"Dyscalculia is a term referring to a wide range of life long learning disabilities involving math… the difficulties vary from person to person and affect people differently in school and throughout life".

NCLD (2009)

Key Features (2)

- What is "**mathematical ability**" ?
- "**Mathematics Disorder**"
  - implies a stable cognitive root
  - not achievement or mastery which is subject to education and environment
  - Not assessed by achievement test

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The National Numeracy Strategy 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**

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Key Features (1)

- "**ability to acquire** " emphasises acquisition rather than carrying out arithmetic procedures.
- "**difficulty understanding simple number concepts, lack an intuitive grasp of numbers"** placing understanding at the core of dyscalculia

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"A lack of a true comprehension or understanding of maths will be a key characteristic of dyscalculic people"
Chinn S. (2006)

Key Features (2)

"Learning number facts and procedures" : more dyslexia related?

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Prevalence

According to current estimates
Butterworth (2002)

- About 40% of dyslexic children have some degree of difficulty with learning mathematics
- Additionally 5 to 6% of children of average to superior intelligence having a specific learning deficit in mathematics.

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Geary (2004)	5 - 8%
Desoete et al (2004)	3 - 8%
Butterworth (2002)	5 - 6%
Kosc (1974)	6.4%
Gross-Tsur et al (1996)	6.5%

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DysCalculiUM

A first-line screening tool for dyscalculia focusing on
Understanding Mathematics

Developed by Trott and Beacham, Loughborough University

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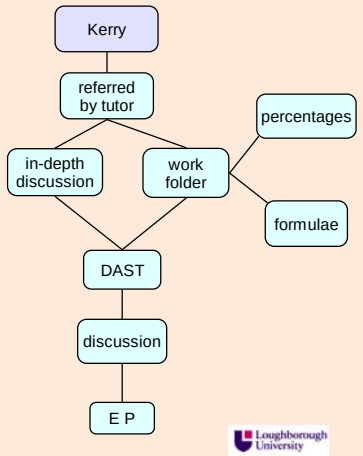
Kerry



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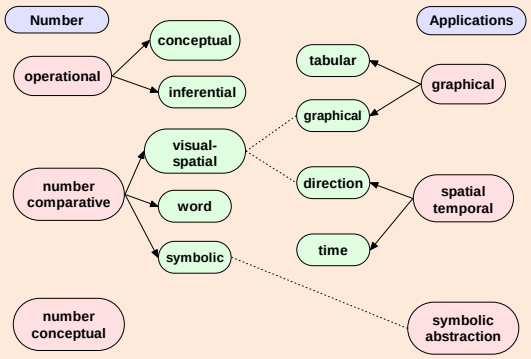
Model for Dyscalculia



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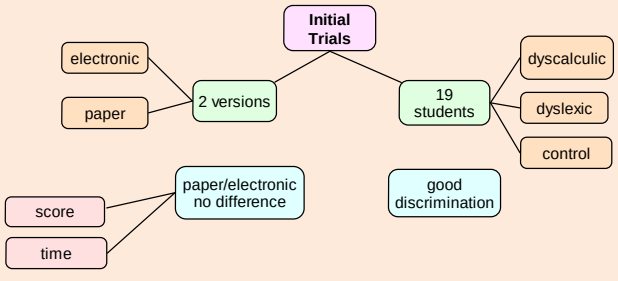
Initial Trials



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Further Trials

- Involved 30 participants
- Organised into three equal groups
  - Dyscalculic
  - Dyslexic
  - Control
- Covered a range of academic subjects

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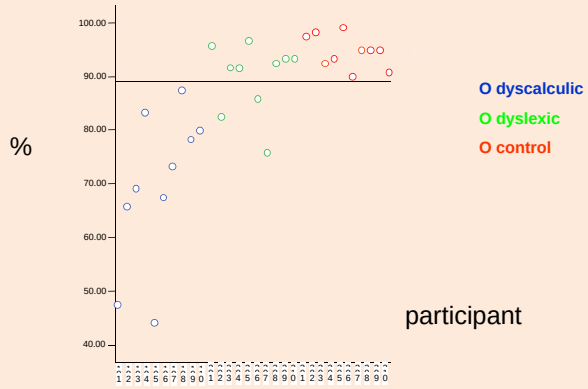
Percentage Scores for 3 Groups



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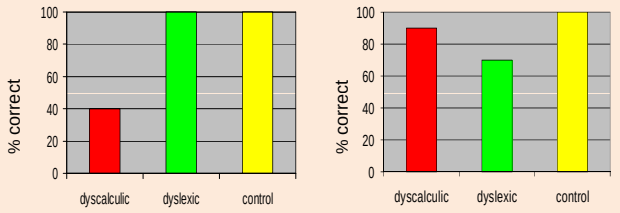
Compare
3.59 with 3.509

Compare
0.71 with 0.17



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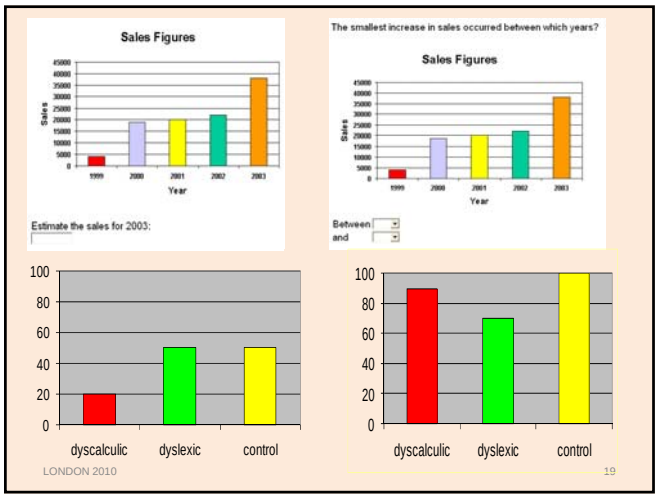
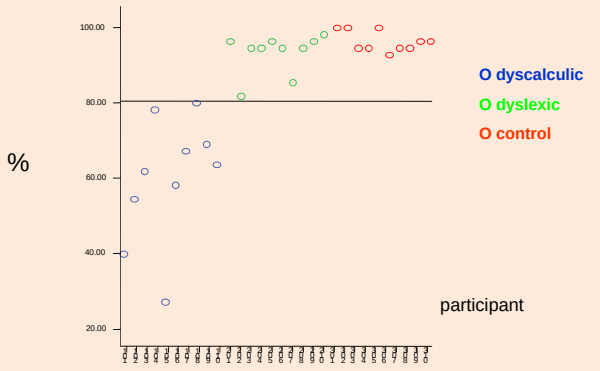
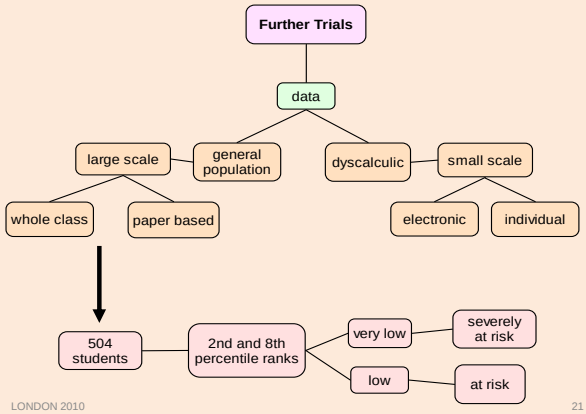


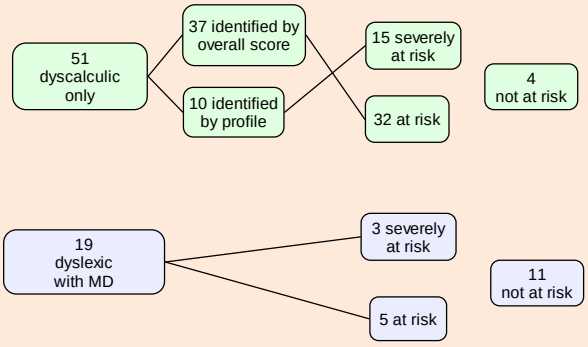
Graph: percentage scores (revised)



Further Trials



"Small-Scale" Trials, n = 70



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Profiler (Thomas)

OVERALL SCORE			
No Conceptual			
No Comparative: Word			
No Comparative: Symbol			
No Comparative: VisSpat			
Graphical			
Tabular			
Symbolic Abstraction			
Spatial Direction			
Time			
Operational: Conceptual			
Operational: Inferential			

- Overall: "severely at risk "
- Risk:
  - No. concepts
  - No. comparisons
  - Operations

Key concepts

- Not at risk
  - Graphical
  - Tabular
  - Time
  - Spatial

More visual applications

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DysCalculiUM

- Online large-scale screener for dyscalculia
- On-line delivery of screening tool to identify students at risk with minimal staff input
- Profiler identifies students requiring further investigation that can be:
  - In depth interview
  - Referral for further testing

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DysCalculiUM process

Learner accesses DysCalculiUM portal
- Completes screener
- Results automatically analysed

Tutor access DysCalculiUM portal
- Reviews students results & profiles
- Identify students who are at risk

Further investigation of difficulties
- Tutor-led interview

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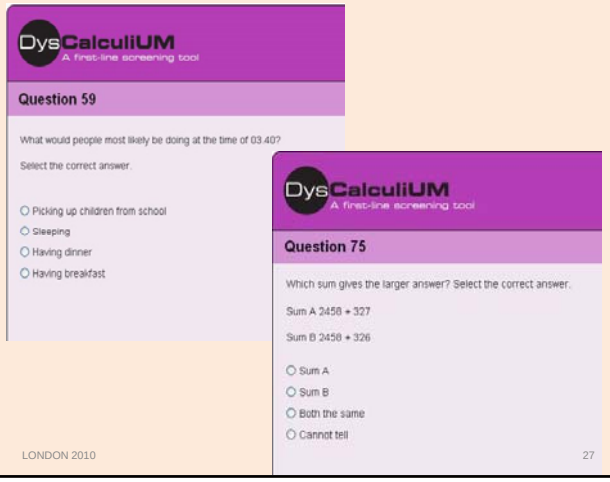

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One-to-one Support for the Dyscalculic Student

A Case Study: Liam

Liam: Transport Management

Strengths

- Verbal reasoning
- Expressive writing
- Reading comprehension

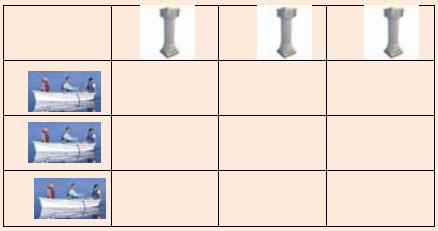
Weaknesses

- Dyscalculic
- Sequencing numbers
- Problems with calculation
  - Unsure of basic operations
  - Use of inappropriate strategies

Tables of Information

Birmingham to	Minutes late (to nearest minute)			
	On time	1 to 5	6 to 10	Over 10
Paris	8	3	1	0
Brussels	6	3	1	2
Munich	4	1	0	0
Dublin	7	1	1	1

Rows and Columns



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% of flights to Brussels more than 5 mins late:

Birmingham to	Minutes late (to nearest minute)		TOTAL
	6 to 10	Over 10	
Brussels	1	2	12

$$1+2=3$$

$$\frac{3}{12}=\frac{1}{4}$$

$$=25\%$$

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Alternative Approaches

$$12 \text{ flights} = 100\%$$

$$1 \text{ flight} = \frac{100}{12}$$

$$3 \text{ flights} = \frac{100}{12} \times 3$$

12 flights

3 late

$$\frac{3}{12} \times 100$$

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Median of delivery route distances (km)

66	72	46	72	45	69	70	55	46	35

35 45 46 46 55 66 69 70 72 72

60 | 61

60.5

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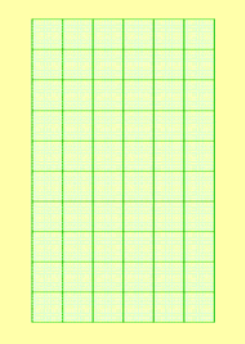
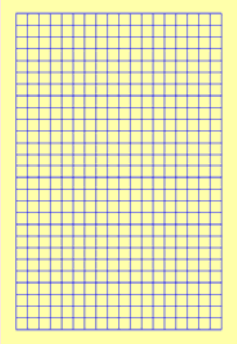
Resources





http://incompetech.com/beta/plainGraphPaper/

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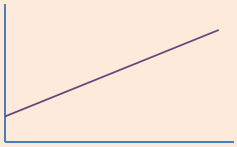
Number Lines and Graphs

- Number line

- Extend to 2-D
- Moving axes



- Apply to
  - Correlation
  - Sales forecasting (interpolation)

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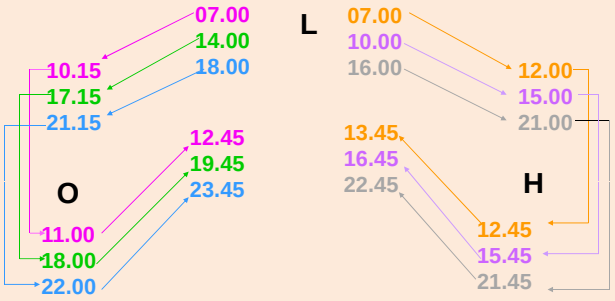
Time and Scheduling

A small airline, based at LHR, serves two cities: Oslo and Helsinki. The flying time to Oslo is $2^1/_4$ hours and to Helsinki is 3 hours. There should be 3 return flights a day to each city and the turn-round time must be at least 40 minutes, but not more than 1 hour.
Construct a schedule.

	Helsinki 1
Start	07.00
Fly time	03.00
Land GMT	10.00
Time Difference	02.00 +
Land local	12.00
Turn round	00.45
Start local	12.45
Fly time	03.00
Land local	15.45
Time difference	02.00 -
Land GMT	13.45



Dyscalculia: The Way Forward

There is an urgent need for:

- Effective screening and assessment
- An understanding of student support needs

With appropriate support the dyscalculic student can move forward and succeed.

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