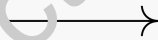


28.6.2025



## Dyscalculia: EDA working definition

EDA Dyscalculia Academical Committee  
Karagiannakis, G.  
Noël, M-P.  
Gilmore C.



### Definition Recourses

Working Dyscalculia definition resources:

- DSM-V
- ICD-10
- Diagnosing SLD: Consensus conference of the Italian National Institute of health (2014)
- The diagnosis and treatment of dyscalculia (Germany: Habertroh & Schlöte-Köhne, 2019)
- SASC definition of specific learning difficulty in mathematics (UK, 2025)
- Research evidences
- Clinical observations

(Karagiannakis, G., Noël, M-P. & Gilmore C., EDA Dyscalculia Academical Committee)

### DSM - V

Dyscalculia is defined as a specific learning difficulty characterized by deficiencies in

- ❑ **number sense** (processing of numerosities and understanding of quantities)
- ❑ **fact retrieval** (single-digit arithmetic, i.e., addition & multiplication tables)
- ❑ **calculation** (multi-digit arithmetic)
- ❑ **mathematical reasoning** (applying arithmetical concepts, facts or procedures to solve mathematical problems)

### EDA Dyscalculia Working Definition

*Dyscalculia is a neurodevelopmental disorder characterised by persistent and unexpected difficulty in:*

- A) *understanding of numbers and mathematical symbols,*
  - B) *mathematical fact retrieval,*
  - C) *calculations,*
  - D) *mathematical reasoning or*
  - E) *geometry (see Table 1)*
- despite the provision of effective classroom instruction.*

*These difficulties typically result from **domain specific** deficits in: numerical and mathematical symbol processing and understanding (core dyscalculia) and/or **domain in general** deficits in executive functions (working memory, inhibition, flexibility), hypersensitivity to interference in memory, visual-spatial processing or reasoning language.*

(Karagiannakis, G., Noël, M-P. & Gilmore C., EDA Dyscalculia Academical Committee)

| Domain                                | Mathematical skills                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A. Number-Symbol Understanding</b> | <b>Number Magnitude</b> <ul style="list-style-type: none"> <li>• Subitizing</li> <li>• Compare collections</li> <li>• Estimate the cardinal of collection</li> </ul> <b>Symbolic Number System</b> <ul style="list-style-type: none"> <li>• Understanding the cardinal meaning of number words</li> <li>• Understanding the magnitude of the arabic digits</li> <li>• Understanding the based-10 system</li> <li>• Understanding the rational numbers (decimals, fractions, percentages)</li> <li>• Understanding negative numbers</li> </ul> <b>Mathematical symbols</b> <ul style="list-style-type: none"> <li>• Understanding the operational symbols (+, -, x, =) and words (plus, minus, times, divided, equal)</li> <li>• Understanding and converting units of measurements</li> <li>• Understanding the powers and exponents</li> <li>• Understanding the meaning of the letters in algebra</li> </ul> |
|                                       | <b>B. Math Facts Retrieval</b> <ul style="list-style-type: none"> <li>• Knowing/ recalling mathematical formulas (area, functions, etc)</li> <li>• Knowing and retrieving mathematical terminology (sum, difference, product, quotient, rate, denominator, square, etc)</li> <li>• Knowing and retrieving frequently the arithmetical facts (times tables, addition facts)</li> <li>• Knowing and retrieving the counting list (one, two, three,...)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                       | <b>C. Calculations (understand and apply algorithms)</b> <ul style="list-style-type: none"> <li>• Algebraic calculations</li> <li>• Written and mental calculations</li> <li>• Mental arithmetic calculations</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                       | <b>D. Math Reasoning</b> <ul style="list-style-type: none"> <li>• Justification</li> <li>• Select the most efficient strategy</li> <li>• Mathematical modeling of problems (numerical, word, geometrical)</li> <li>• Interplay between 2D and 3D representations</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                       | <b>E. Geometry</b> <ul style="list-style-type: none"> <li>• Estimate length, area, volume, angles, etc of objects</li> <li>• Mental manipulation (translation, transformation, rotation, etc) of geometrical shapes</li> <li>• Sensitivity to size and shape of objects</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

## EDA, Dyscalculia Working Definition

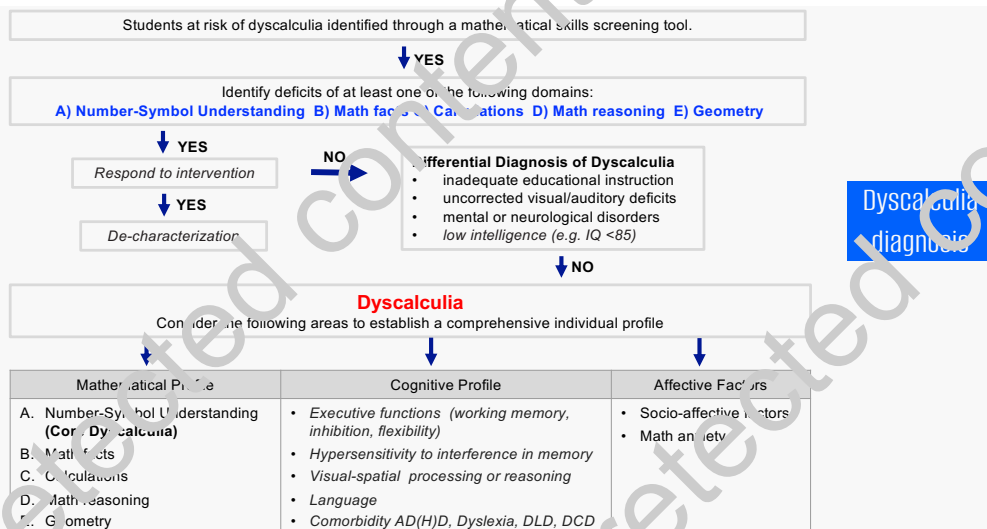
- This list (not exhaustive) outlines developmental trajectories of key mathematical domains.
- Importantly, most mathematical tasks engage multiple domains simultaneously.
- For example, solving a complex multi-digit calculation requires not only the ability to execute arithmetic procedures and manage intermediate steps in working memory, but also an understanding of number magnitude, the base-10 positional system, and retrieval of arithmetic facts from memory.
- Similarly, placing a fractional number on a number line involves comprehending the meaning and size of the fraction, while also processing the visual-spatial layout of the number line.

(Karagiannakis, G., Noë, M-P. & Gilmore C., EDA Dyscalculia Academeical Committee)

## EDA, Dyscalculia Working Definition

- ✓ The condition is typically persistent and the symptoms may change over time.
- ✓ Poor response to effective instruction is a key diagnostic signal.
- ✓ Dyscalculia/SpLD in maths exists on a continuum; no strict cut-off defines its presence.
- ✓ Influenced by genetic and environmental factors; no single cause explains all cases.
- ✓ Frequently co-occurs with ADHD, DLD, dyslexia, OCD
- ✓ Mathematics anxiety is also frequently present but not diagnostic.
- ✓ Not caused by low IQ, poor instruction, or sensory issues (exclusion criteria)
- ✓ Although low intellectual functioning constitutes an exclusion criterion for the diagnosis of developmental dyscalculia, reduced fluid intelligence adversely affects performance on mathematical reasoning tasks.

(Karagiannakis, G., Noë, M-P. & Gilmore C., EDA Dyscalculia Academeical Committee)



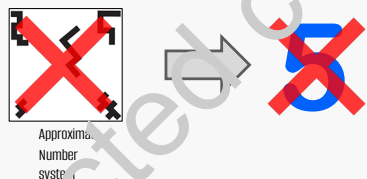
(Karagiannakis, G., Noë, M-P. & Gilmore C., EDA Dyscalculia Academeical Committee)

Extra slides

## Causes of Dyscalculia

Domain specific cognitive deficit

Number Module Deficit



Symbolic Access Deficit



ANS activity might only play a predictive role in early informal mathematics (Cannon et al., 2022)

No evidence for a core deficit in developmental dyscalculia or MLD (Mazzarella et al., 2021)

## Causes of Dyscalculia

Domain general cognitive deficit

Executive functions

A Working Memory/Updating  $5 + 3 \times 2 =$

B Inhibition  $3.15 > 3.2$   $\frac{1}{4} + \frac{1}{4} = \frac{2}{8}$

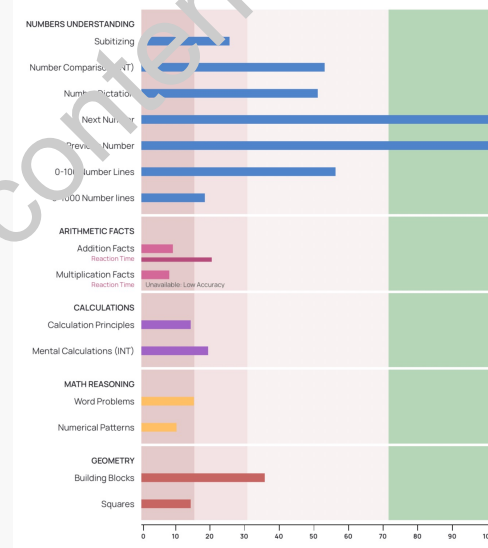
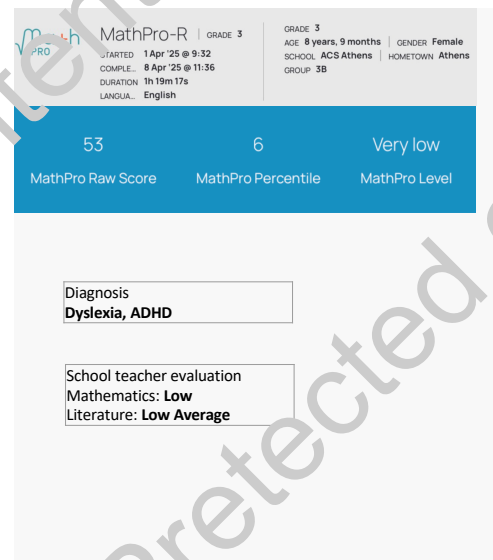
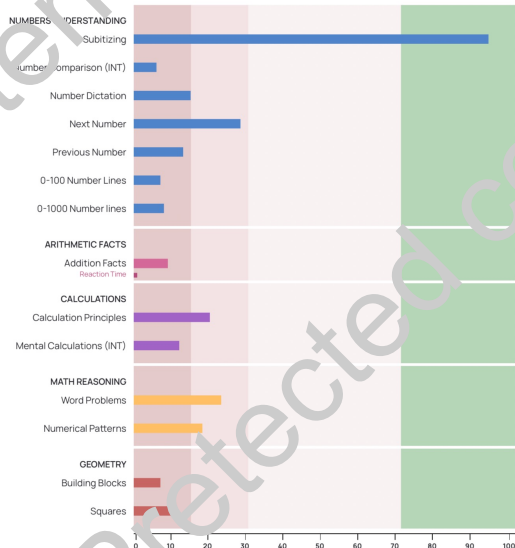
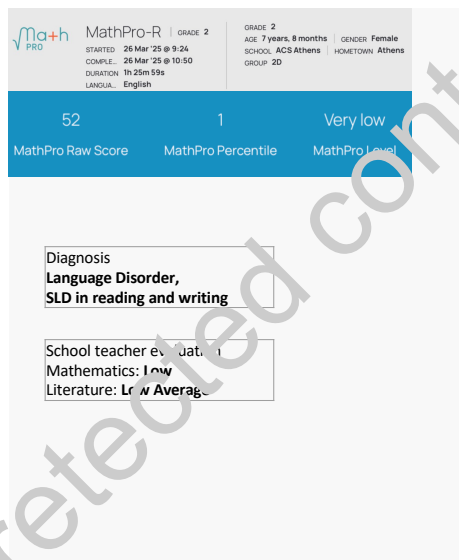
C Shifting/Flexibility  $99 + 46 =$

$$x^2 - 5x + 6 = 0$$

$$x^2 - 5x = 0$$

D Interference  $x + x = 2x$   $3 \times 8 = 24$   $3 \cdot 2 \text{ Vs } 3^2$   
Hypersensitivity  $x \cdot x = x^2$   $4 \times 8 = 32$   $2\pi r \text{ Vs } \pi r^2$

F Visuo-spatial skills 2-5, 6-9, 4-7  $> < + \times$



MathPro-R | GRADE 4  
STARTED: 9 Apr '25 @ 11:02  
COMPLETED: 11 Apr '25 @ 9:39  
DURATION: 1h 7m 21s  
LANGUAGE: English

GRADE 4  
AGE 9 years, 5 months  
SCHOOL ACS Athens  
HOMETOWN Athens  
GROUP 4D

89 MathPro Raw Score  
65 MathPro Percentile  
Average MathPro Level

Diagnosis  
SLD in reading, SLD in writing

School teacher evaluation  
Mathematics: Low Average  
Literature: Low Average



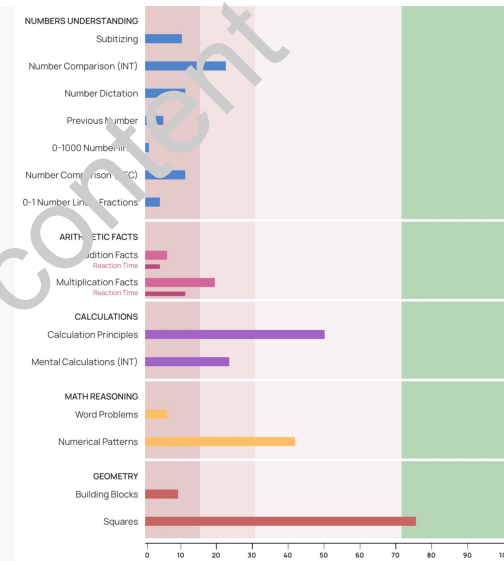
MathPro-R | GRADE 4  
STARTED: 9 Apr '25 @ 9:19  
COMPLETED: 11 Apr '25 @ 13:59  
DURATION: 1h 44m 37s  
LANGUAGE: English

GRADE 4  
AGE 9 years, 7 months  
SCHOOL ACS Athens  
HOMETOWN Athens  
GROUP 4B

58 MathPro Raw Score  
4 MathPro Percentile  
Very low MathPro Level

Diagnosis  
SLD Math, SLD Reading, ADHD

School teacher evaluation  
Mathematics: Low  
Literature: Low Average



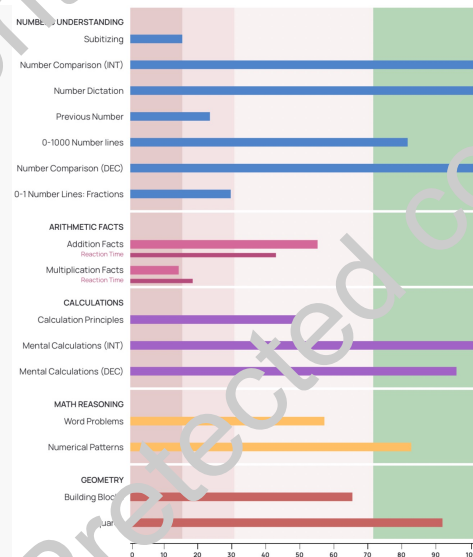
MathPro-R | GRADE 5  
STARTED: 9 Apr '25 @ 11:08  
COMPLETED: 10 Apr '25 @ 13:12  
DURATION: 1h 19m 59s  
LANGUAGE: English

GRADE 5  
AGE 10 years, 10 months  
SCHOOL ACS Athens  
HOMETOWN Athens  
GROUP 5C

85 MathPro Raw Score  
76 MathPro Percentile  
High MathPro Level

Diagnosis  
SLD reading and writing

School teacher evaluation  
Mathematics: Low Average  
Literature: Low Average



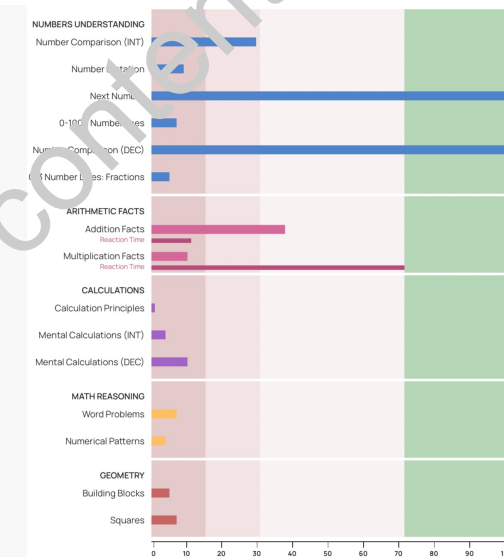
MathPro-R | GRADE 6  
STARTED: 29 Apr '25 @ 8:56  
COMPLETED: 30 Apr '25 @ 10:33  
DURATION: 1h 25m 7s  
LANGUAGE: English

GRADE 6  
AGE 11 years, 6 months  
SCHOOL ACS Athens  
HOMETOWN Athens  
GROUP Period 6

54 MathPro Raw Score  
1 MathPro Percentile  
Very low MathPro Level

Diagnosis  
SLD in mathematics, ADHD

School teacher evaluation  
Mathematics: Very Low  
Literature: Low Average



MathPro

PRO

MathPro-R

GRADE 6

STARTED 29 Apr '25 @ 10:19

COMPILE 30 Apr '25 @ 10:32

DURATION 1h 22s

LANGUAGE English

GRADE 6

AGE 11 years, 8 months

SCHOOL ACS Athens

GROUP Period 7

GENDER Female

HOMETOWN Athens

30

1

Very low

MathPro Raw Score

MathPro Percentile

MathPro Level

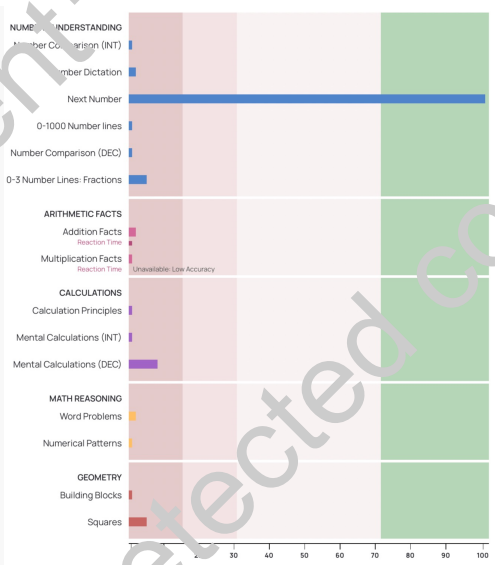
Diagnosis

SLD in reading, writing and math

School teacher evaluation

Mathematics: Very Low

Literature: Low



MathPro

PRO

MathPro-R

GRADE 6

STARTED 29 Apr '25 @ 11:33

COMPILE 30 Apr '25 @ 12:32

DURATION 58m 44s

LANGUAGE English

GRADE 7

AGE 12 years, 11 months

SCHOOL ACS Athens

GROUP Period 7

GENDER Female

HOMETOWN Athens

52

1

Very low

MathPro Raw Score

MathPro Percentile

MathPro Level

Diagnosis

SLD in mathematics

School teacher evaluation

Mathematics: Very Low

Literature: Low Average

