Mathematical learning difficulties
Short introduction

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• Who are these children and adults with learning difficulties in mathematics?
  • introduction video (30 min) + discussion
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• What kind of weaknesses in mathematics?

• The origins of the problems in learning mathematics

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Introduction video (30 min)

- The documentary DIVIDED BY NUMBERS – studying with dyscalculia gives you an accurate 30-minute-impression of the world according to youngsters with dyscalculia. Young pupils, students and parents testify on the difficulties they experience during their educational career, and give an impression of how they successfully overcame the thresholds on their way. Experts comment on insights and different points of interest about this disability. The video is done by Artevelde University College Ghent, Belgium. There are subtitles in English.
Who are they?

**Mathematical learning disability**
- Dyscalculia
- Mathematics disorder

ICD-10: 5-7%

**Mathematical learning difficulties**
- Low achievement in mathematics
- Low performance in mathematics

15-20%

**Average performance**

Intensity, specificity and time needed to practice/extra support grows

Berch & Mazzocco 2007, Geary 2013; Price & Ansari 2013
What kind of difficulties in mathematics learning?

- Potentially weakness in nonverbal number sense (Geary 2013)
  - magnitude comparison (De Smedt et al. 2013; Desoete, Ceuleman, De Weerdt & Pieters, 2012; Mazzocco et al. 2011; Rouselle & Nöel 2007; Stock et al. 2009a; Toll & Van Luit, 2014)

- Counting skills recite number word sequence and enumerate (slow, error rich) (Hassinger-Das, Jordan, Glutting, Irwin & Dyson 2014; Navarro et al. 2012; Stock et al. 2009a; Toll & Van Luit 2014)

Cognitive, neuropsychological and neurobiological factors related to MLD
(Berch, D. & Mazzocco, M. 2007)

- Cognitive and information processing features
  - information processing deficits
  - strategy use, long term memory, working memory
  - language learning difficulties
- Neuropsychological factors
  - math and SLI
  - syndromes and math
  - ADHD and math
- Neurobiological and Genetic Substrates
  - neuroanatomical approaches
  - quantitative genetics
- Additional influences on mathematical difficulties
  - math anxiety
  - gender, ethnicity, motivation, low SES, not possibilities to learn
1. The left angular gyrus (AG)
2. The left intraparietal sulcus (IPS)
3. The right intraparietal sulcus (IPS)

\[2 + 3 = ?\]

3 vs. 8

Image source:
Assessment

Early identification & Follow-up the development


• Following the development and learning frequently enough.

• Multidimensional assessment.

• Multi-professional assessment work.
Educational interventions

- An *educational* intervention is a planned modification of the *learning* environment made for the purpose of altering behavior *or development* in a prespecified way (Riley-Tillman & Burns, 2009)

- Evidence-based practice demands have increased and also the research on interventions
  - Can we find intervention beneficial for all learners?
  - Publication bias – the studies published with positive effects, what about zero effects or negative effects?
  - Cultural-free-interventions: Can we transport a program having positive effects to other culture?
Extra educational support & intervention studies

- second graders ($M_{\text{age}} = 8$ years, 2 months) with low performance in mathematics,
- in a quasi-experimental, intervention-control setting.
- A group of low-performing second graders (LOWi, $n = 11$) was taught twice a week for eight weeks on the mathematics topics of number word sequence skills, counting skills and conceptual place value knowledge.
- The intervention’s effectiveness was examined by comparing the mathematics performance of the LOWi group to those of two groups consisting of low-performing (LOWc, $n = 13$) and typically performing children (TYPc, $n = 64$), who followed their business-as-usual mathematics instruction.
- The LOWi group made significant improvements in mathematics but did not show significantly better gains, compared to the LOWc and TYPc groups, immediately and three months after the intervention.
Mononen & Aunio, 2014
Pre-test, post-test and delayed post-test performances by group on the mathematics combined scale and addition and subtraction facts measures

- Mathematical learning difficulty = Individual Educational plan in mathematics and learning difficulty status
- Effective features of instruction:
  - Explicit instruction
  - Student verbalization of their mathematical reasoning
  - Visual representations
  - Range and sequence of examples
  - Multiple and heuristic strategies (not tasks dependent)
  - Giving teachers ongoing formative assessment data and feedback on students’ mathematics performance
  - Providing data and feedback to LD students on their mathematics performance
  - Peer-assisted mathematics instruction
Literature (1)


