Dyscalculia in young adulthood: The *Arithmetical Skills Profile* as a starting point for support

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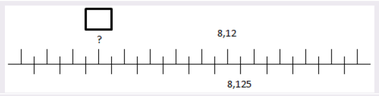
INTRODUCTION

- Math problems are **not always recognized** during elementary school (Barbaresi, Katusic, Colligan, Weaver, & Jacobsen, 2005)
- **Diagnostic instruments for young adults are needed**, however:
  - **Limited** number of instruments
  - Lack of age-appropriate **standards**
  - No **time pressure**
  - No **complete picture** of the different arithmetical skills

- Dyscalculia has a major **impact** (on studies, job, health) and large **individual differences** exist between young adults with dyscalculia (Dowker, 2005; Geary, 2011; Reyna, Nelson, Han, & Dieckman, 2009)
- **Custom-support for young adults is needed**
  - Diagnostic instruments should offer **starting points for support**
  - **Daily life skills** have to be evaluated
  - **Compensatory strategies** have to be evaluated

THE *ARITHMETICAL SKILLS PROFILE*

SPECIFIC ARITHMETIC SKILLS	TOPIC	EXAMPLE OF AN ITEM
Arithmetic fact knowledge	Basic facts, 4 operations	3 + 2; 9 x 7; …
Conceptual knowledge	Number transcoding: verbal to arabic & arabic to written	dictation of '908 809'
	Symbols	1/5 …… 0,5 (< or > or =)
	Number line	
	Grasp of fractions and decimals	5/8 = ?
	Arithmetical terminology (& mental representation)	double; product, quotient etc
	Measurement units and formulas	780 ml = …… l
Procedural knowledge and skills	Basic operations	3478 + 99900 = ?
	Fractions and percentages	25% of 2800 = ?
Integration	Estimation task	8880 : 30 = ?
ADDITIONAL SKILLS	Word problems	
	Tables and charts	
	Spatial orientation	
	Clock reading and time telling	
	Money skills	
COMPENSATORY STRATEGIES	Columnar calculations	
	Calculator use - visual	
	Calculator use - auditory	
METACOGNITIVE ABILITY	For each topic separately	 Duid aan hoe je jezelf beoordeelt op de opdrachten van deze pagina. Kleur het bolletje. Heel zwak / Zwak / Eerder zwak / Eerder goed / Goed / Heel goed

PARTICIPANTS

77 first-year students nursing (16 male, 61 female; mean age 20 years)
8 students did not have Dutch as their mother tongue
Previous education (general education (ASO; 3-4 h math), technical education (TSO; 0-4 h math) and professional education (BSO; 0-2 h math))

	Male	Female	Total
ASO	7	16	23
TSO	8	40	48
BSO	1	5	6
Total	16	61	77

math difficulties or dyscalculia?

	Male	Female	Total
Math intervention	3	11	14
Dyscalculia	0	4	4
Total	3	11	14

PROCEDURE

- Paper and pencil test in the classroom, by a lecturer
- Time limit for each topic (based on pilot testing)
- Only specific arithmetical skills (part 1) and word problems (first topic of part 2) because of time constraints (about 1 hr)

RESULTS - ACCURACY

Figure 1: Fact knowledge

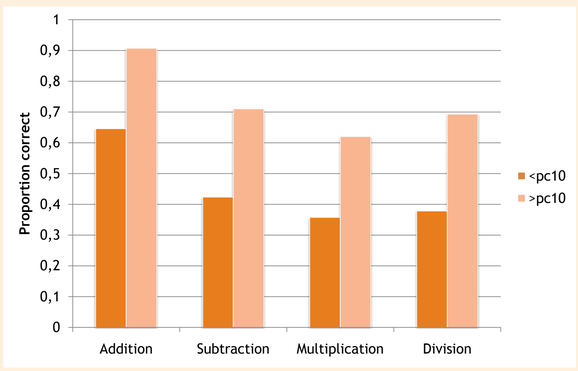


Figure 2: Conceptual knowledge

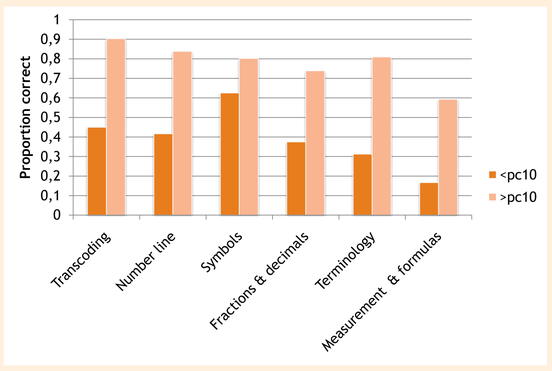


Figure 3: Procedural knowledge & skills

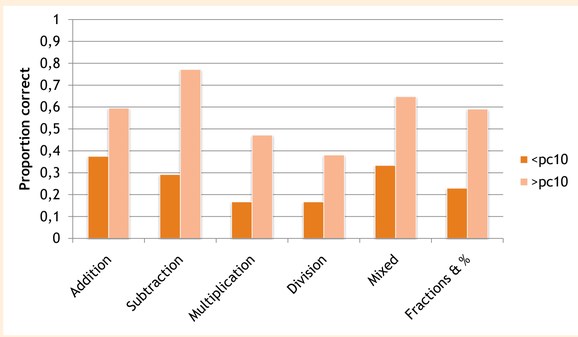
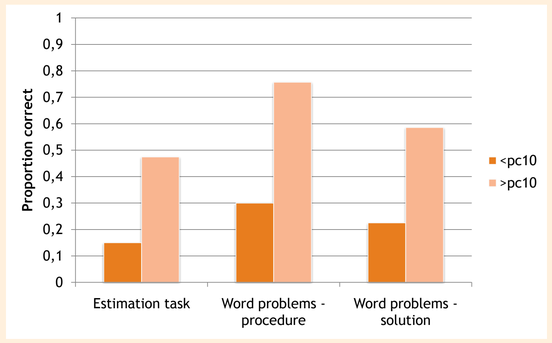


Figure 4: Integration



RESULTS – QUALITATIVE ANALYSIS OF TYPES OF ERRORS

	Pc>10	Pc<10
Fact knowledge		5-times and 6-times table Generally weak automatisation
Conceptual knowledge	Fractions Formulas	Transcoding Terminology Fractions and decimals
Procedural knowledge	Calculation errors	Immature procedures Procedures with fractions and decimals
Integration	Estimation	Estimation Word problems (relevant info)

RESULTS - IDENTIFICATION

Group with **score < pc 10**:
- 2 with dyscalculia
- 3 with a history of math intervention
- 1 with a different mother tongue
- 2 'unexplained' cases

Group with **score > pc 10**:
- 2 students with dyscalculia and history of math intervention (and comorbid AD(H)D)
- 7 students with a history of math intervention

RESULTS - RELIABILITY

Cronbach's α = 0.84

CONCLUSIONS AND FURTHER STEPS

- Five students with dyscalculia or history of intervention for math were identified, two students with dyscalculia and seven with a history of intervention were not identified
  - Time limits too broad → adapted
  - Intervention influences test results?
- Standardization of the instrument in a large group of 6th graders is running
- Screening of arithmetical skills offers interesting insights into students' abilities *and* starting points for instruction/remediation/support
- The advantages and consequences of digitalisation of the instrument are now investigated

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