

Introduction

Three to fourteen percent of the Western population suffers from mathematical disabilities (MD; Desoete, 2007; Dowker, 2005). MD are often defined as persisting impairments in mathematical abilities that are not caused by a secondary factor and that are unexpected based upon age, intelligence and school placement (APA, 2000; WHO, 1992). Working memory (WM) might underlie MD (e.g., Bull & Scerif, 1999; Swanson & Jerman, 2006). Although many have investigated the role of WM in MD, results remain ambiguous concerning the central executive (CE), the visuospatial sketchpad (VSSP) and the phonological loop (PL; Passolunghi & Cornoldi, 2008). In addition, prevalence of children with MD experiencing reading and/or spelling disabilities is estimated between 30% and 50% (Light & De Fries, 1995; Shalev, 2000,2004). Despite this high prevalence and the fact that WM deficits were found in reading disabilities (Chiappe, Hasher, & Siegel, 2000; Jeffries & Everatt, 2004), as well as in spelling disabilities (Hasselhorn, Schuchardt, & Mahler, 2010; Steinbrink & Klatt, 2007), only few MD studies have taken reading and spelling into account (Shalev, Manor, & Gross-Tsur, 2005; van der Sluis et al., 2005). As a consequence, one might expect a significant influence of working memory in reading and spelling in children with mathematical disabilities, especially for the phonological loop and the central executive (Jordan et al., 2007; Landerl & Moll, 2010; Schuchardt, Kunze, Grube, & Hasselhorn, 2006).

Two **research questions** were answered:

- Do children with MD still have sig. lower scores on WM tasks than average achieving children when controlling for reading (Passolunghi, 2004) ?
- Do children with MD still have sig. lower scores on WM tasks than average achieving children when controlling for spelling (Schuchardt et al., 2006)?

Method

Participants

	Control (N=55)	MD (N=36)
Age in months	119.96 (11.02)	120.83 (11.80)
FSIQ	108.58 (9.85)	95.42 (8.39)
M:F	25:30	6:30

Instruments & procedure

Session 1 and 2

Math tests

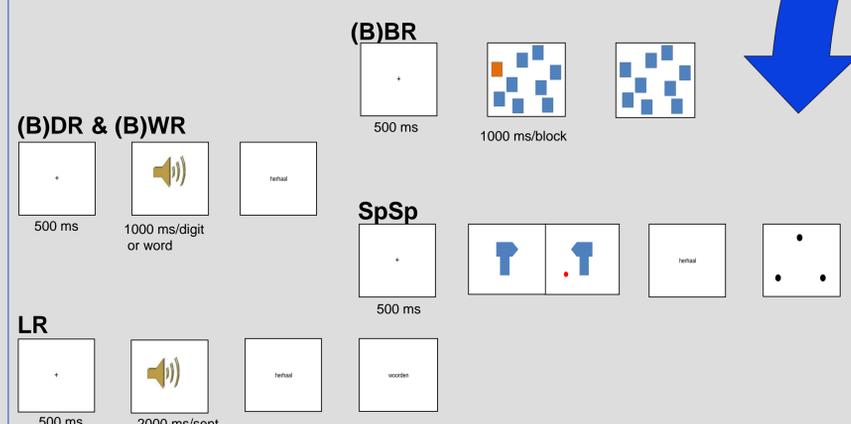
- Arithmetic Number Facts Test
- Courtrai's Arithmetic Test Revised

Spelling test

- PI-dictation

Reading tests

- One Minute Test
- Klepel



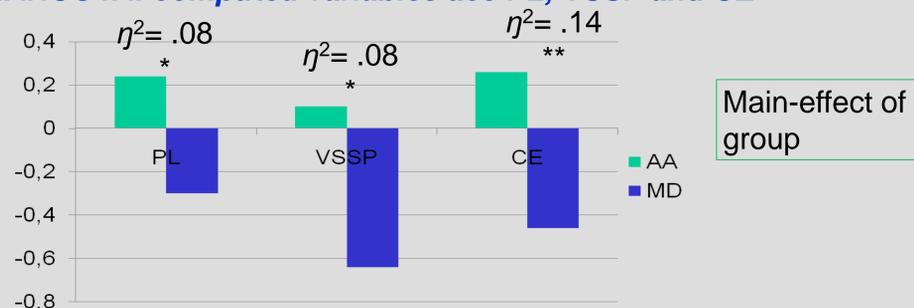
Session 3

WM tasks

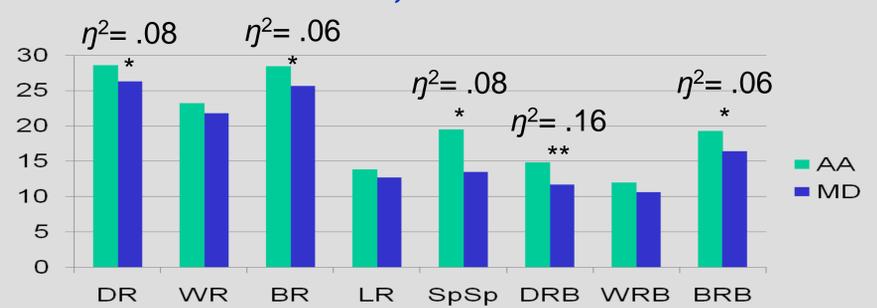
- Based on multi-component model of Baddeley (1986)
- WMTB-C & AWMA:
 - *Phonological Loop*
 - Digit Recall (DR)
 - Word Recall (WR)
 - *Visuospatial Sketchpad*
 - Block Recall (BR)
 - *Central Executive*
 - Listening Recall (LR)
 - Backward Digit Recall (BDR)
 - Backward Word Recall (BWR)
 - Backward Block Recall (BBR)
 - Spatial Span (SpSp)

Results

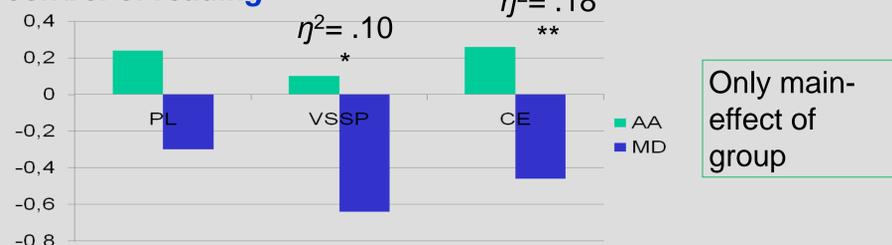
MANCOVA: computed variables acc PL, VSSP and CE



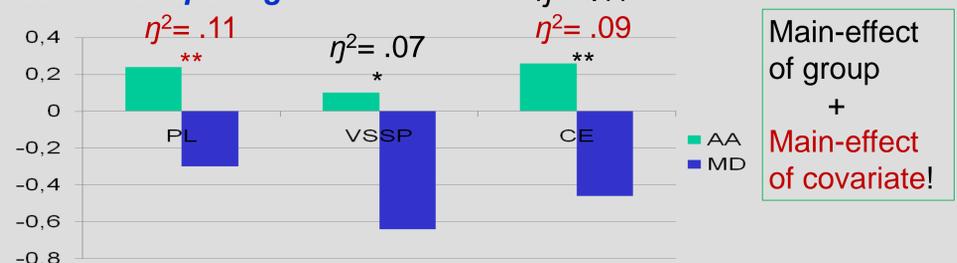
ANCOVA's raw scores acc PL, VSSP and CE



MANCOVA: computed variables acc PL, VSSP and CE, in control of reading



MANCOVA computed variables acc PL, VSSP and CE, in control of spelling



Discussion

Children with MD seem to experience problems with WM, with the CE being the most influential component. However, these problems are not related to the verbal modality: children with MD do not differ from average achieving children on WR, BWR and LR. In addition, when controlling for reading, group differences on PL disappeared. Even more remarkable is the impact of spelling in both the PL and CE.

These results show that studying WM in children with MD without taking reading and spelling performance into account, might provide us with a restricted and/or blurred picture. To gain a better inside in the interrelationships of reading, spelling, math and WM, further research is recommended.