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# THE USE OF CALCULATION STRATEGIES IN ARITHMETIC WORD PROBLEM SOLVING: GROUP DIFFERENCES IN ELEMENTARY SCHOOL

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# Mathematic Learning Disabilities

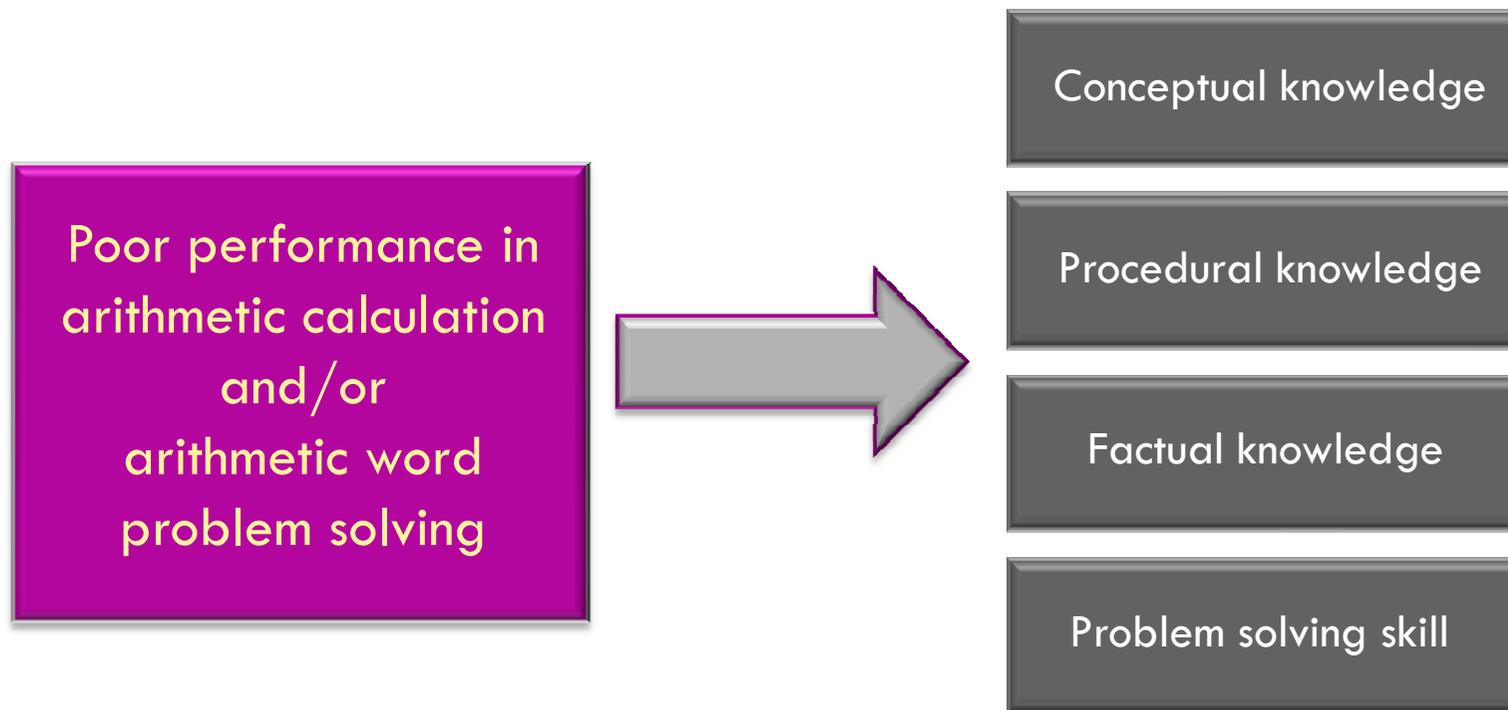
- Definition of Mathematic Learning Disabilities (MLD) formulated by the government of the Autonomous Community of the Canary Islands:

Children with Mathematic Learning Disabilities lie two years behind on curricular arithmetic tasks and perform below the 25<sup>th</sup> percentile on standardized calculation tests. Occasionally, they demonstrate poor comprehension of arithmetic word problems.

(BOC N° 250 - December 22, 2010)

- 4% - 7% of school age children have Mathematic Learning Disabilities  
(Mazzocco, 2007)

# Arithmetic domain components



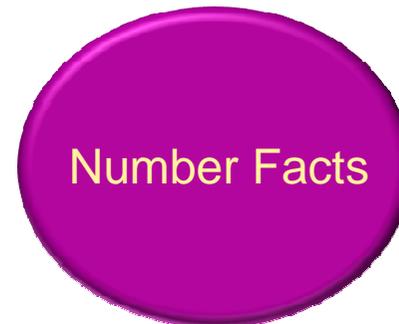
(Andersson, 2010)

# Procedural knowledge

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- ❁ Procedural knowledge is vital during arithmetic word problem solving, as it accounted for a significant amount of the variation on word problems (Andersson, 2010)

## CALCULATION STRATEGIES



# Calculation strategies



- 🌀 Studies have demonstrated that children with MLD use calculation strategies that tend to be developmentally immature (Jímenez & García, 2002; Ostad, 1998)

# Aim of the study



- 🌀 To examine how the correct use of calculation strategies in word problem solving develops across grades.
- 🌀 To examine if there are differences between achievement groups in the correct use of different calculation strategies in word problem solving.

# Hypotheses



- 1) Direct Modeling:** It was expected that the MLD group uses this strategy as much as the High Achievement (HA) group in second grade. From third grade on, we predicted that the use of this strategy will decrease in the HA group, while the MLD groups will keep relying on it.
- 2) Counting:** It was expected that the HA group uses the counting strategy more than the MLD group in second grade. We predicted that from third grade on, MLD group will use this strategy more than the HA group and this difference will increase, because the use of this strategy in the HA group will decrease, while the MLD group will rely more on it.
- 3) Number Facts:** It was expected that the HA group uses more often the Number Fact strategy than the MLD group. We predicted that the MLD group would not catch up with the HA group.

# Sample

- 1031 students from grade 2, 3, 4, 5 and 6 from six elementary schools in Tenerife and Gran Canaria
- 740 students were selected to participate in this study in order to compare two different achievement groups:
  - The group Mathematical Learning Disabilities (MLD) is classified by their score below the 25<sup>th</sup> percentile on the Arithmetic Calculation Test
  - The group High Achievers (HA) scored above the 75<sup>th</sup> percentile on this test

	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>	N Total Grupo
MLD	71	72	80	60	78	361
HA	83	79	74	74	69	379
N Total Curso	154	151	154	134	147	740

# Instruments

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**Classification Measurement**



## **ARITHMETIC CALCULATION TEST**

Prueba de Cálculo Aritmético (PCA)  
(Artiles y Jiménez, 2009)

**Criterion Measurement**



## **ARITHMETIC WORD PROBLEM TEST**

Problemas Verbales Aritméticos (PVA)  
(Artiles y Jiménez, 2009)

# Design

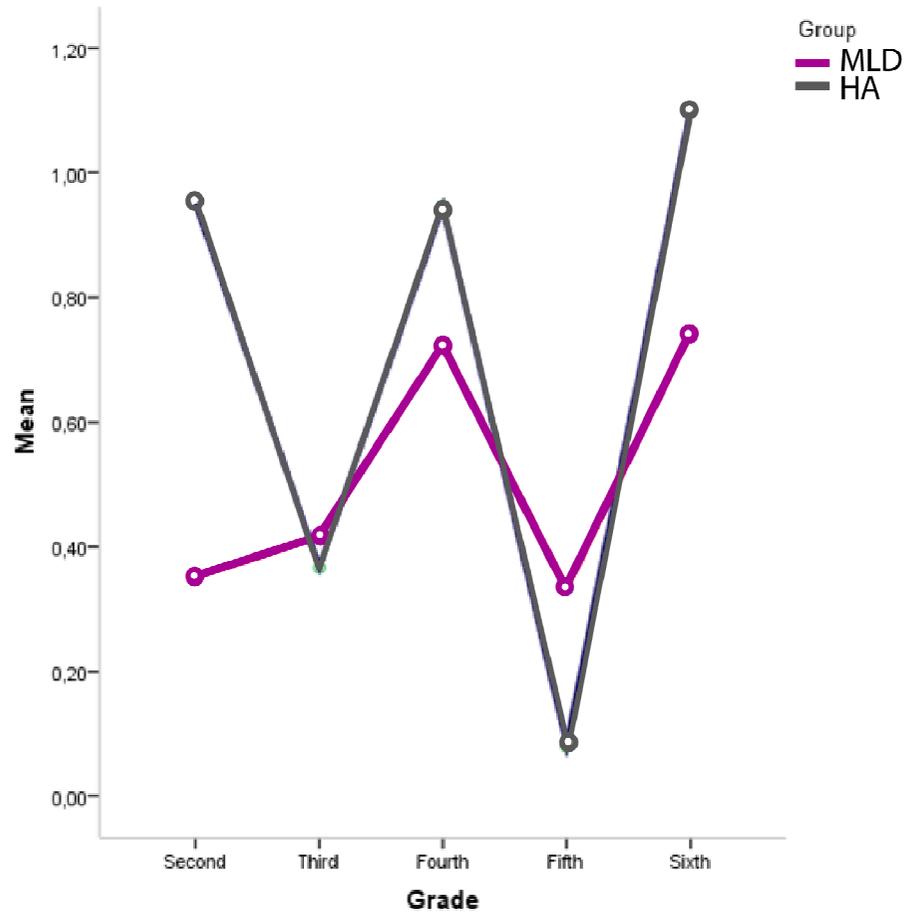


- ANOVA's for each grade were conducted on the arithmetic strategies with group (MLD vs. HA) as independent variable

# Results

## Direct Modeling

MLD = HA  
5<sup>th</sup> ≠ 6<sup>th</sup>

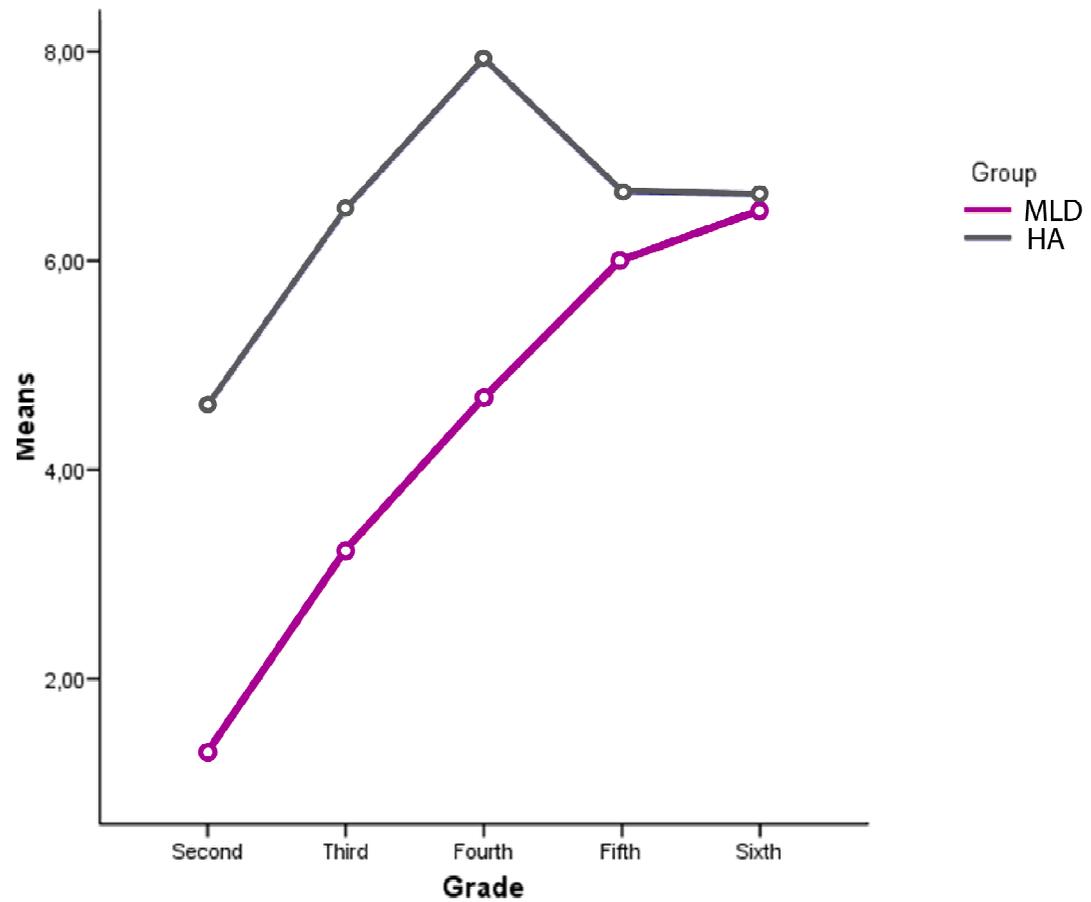


$F(4,730) = 2.88$   $p < .05$ ;  $\eta^2 = 0.16$

# Results

## Counting

- 2<sup>nd</sup> MLD ≠ HA
- 3<sup>rd</sup> MLD ≠ HA
- 4<sup>th</sup> MLD ≠ HA
- 5<sup>th</sup> MLD = HA
- 6<sup>th</sup> MLD = HA

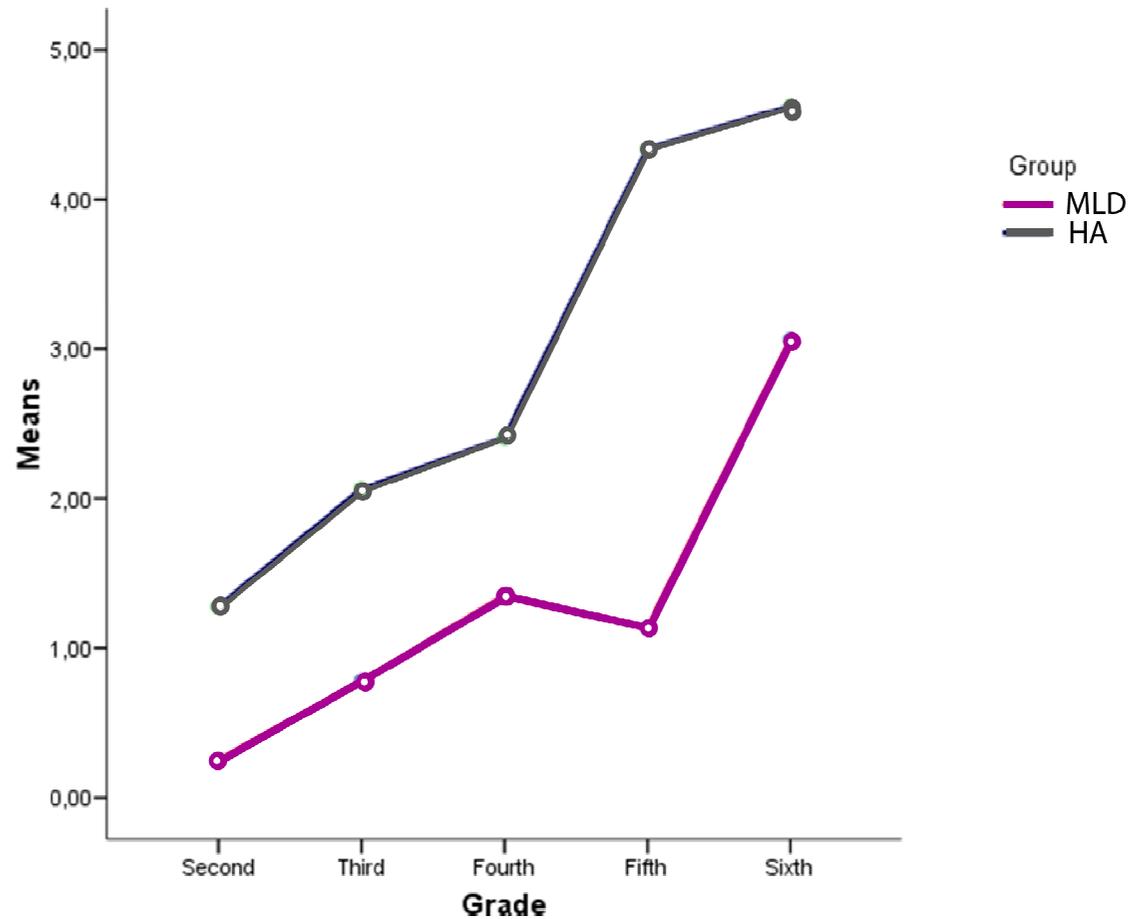


$F(4,730) = 2.92$   $p < .05$ ;  $\eta^2 = 0.16$

# Results

## Number Facts

- 2<sup>nd</sup> MLD ≠ HA
- 3<sup>rd</sup> MLD ≠ HA
- 4<sup>th</sup> MLD ≠ HA
- 5<sup>th</sup> MLD ≠ HA
- 6<sup>th</sup> MLD = HA



$F(4,730) = 2.55$   $p < .05$ ;  $\eta^2 = 0.14$

# Discussion

- 🌀 **Direct Modeling:** There were no group differences found. The difference in the use of this strategy between fifth and sixth graders is probably significant due to characteristics of the word problem solving test.
- 🌀 **Counting:** The HA group uses more frequently the Counting strategy in 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> grade than the MLD group, but in 5<sup>th</sup> 6<sup>th</sup> grade there is no longer a difference. These findings contradict earlier research (Ostad, 1998).
- 🌀 **Number facts:** The development of the number fact strategy in MLD children lags significantly behind on the HA group. In sixth grade, the MLD group makes progress at a fast rate, catching up with the HA group.

# Thanks for your attention

If you are interested  
in Learning Disabilities,  
download this presentation from:

<http://www.ocideidi.net>

