

## I.Re.Ne Lab Innovation and Rehabilitation in Neurodevelopment







# Specific effect of high frequency tRNS over parietal cortex combined with cognitive training on numerical cognition in children and adolescents with dyscalculia

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#### Introduction

- ✓ Established therapeutic options are still scarce for youths with developmental dyscalculia (DD), with little evidence of efficacy [1].
- ✓ Transcranial random noise stimulation (tRNS) has been proposed for improving numerical cognition in typically developed adults [2] and children with DD [1,3].

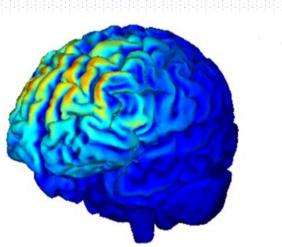
#### **Participants**

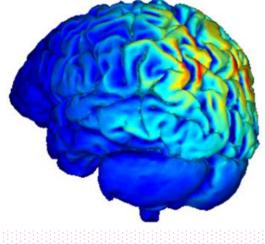
- ✓ 23 children and adolescents with DD
- ✓ 3 groups:

1) Frontal Group tRNS over dIPFC + cognitive training 2) Parietal Group tRNS over PPC + cognitive training

sham tRNS over dIPFC or PPC + cognitive training

3) Sham Group





Matched for age (p = 0.92), nonverbal IQ (p = 0.41) and mathematical scores (p > 0.10)

#### **Methods and Instruments** COGNITIVE TRAINING + tRNS T2/T3 T1 TO WEEK 1 WEEK 2 BDE-2 BDE-2 BDE-2 TTR TTR TTR PEBL PEBL PEBL N-BACK N-BACK N-BACK MO TU WE TH FR GP GP GP MARS MARS MARS **Vektor Training** AMOS AMOS AMOS ... SDSC SDSC SDSC PSI PSI PSI Grid Rotation Tangram Ordering TSAS TSAS **TSAS** 20 min 0.75 mA tRNS (100-500 Hz) SAFETY SAFETY SAFETY EEG EEG EEG PARENT TEACHER RESEARCH GLOBAL FLEX ABO Neuropsychological measures Arithmetic measures Self-report psychological Parent-report psychological Safety and tolerability measure Electrophysiological measure **ALL CHILDREN CAN LEARN**

#### Results

### Clinical Effects of tRNS + Cognitive Training (Mathematical Total Quotient of BDE-2)

Conditions		% T1 m (ES)			% T2 m (ES)			% T3 m (ES)	
	Nq	Cq	NSq	Nq	Cq	NSq	Nq	Cq	NSq
Frontal Group (N = 7)	14.6 (7.7)	10.1 (7.1)	26 (8.1)	0 (11.2)	0.8 (4.4)	3.4 (5.7)	6.6 (11.2)	-1.53 (11.3)	18.6 (11.6)
Parietal Group (N = 7)	11.3 (7.7)	23.5 (7.1)	6.7 (8.1)	5.6 (11.2)	24.9* (4.4)	20.3** (5.7)	41.1 (11.2)	52.6 (11.3)	45.9 (11.6)
Sham Group (N = 9)	3.8 (6.8)	16.7 (6.2)	10.9 (7.1)	-11.5 (9.9)	6.9 (3.8)	5 (5.1)	27.1 (9.9)	25.4 (9.9)	30.8 (10.2)

Legend: m = mean; SE = Standard Error; %T1 = percentage of improvement immediately after the end of the treatment calculated as (T1-T0)/T0\*100; %T2 = percentage of improvement 1-week later calculated as (T2-T0)/T0\*100; %T3 = percentage of improvement 3-month later calculated as (T1-T0)/T0\*100; Nq = number quotient; Cq = Calculation quotient; NSq = Number Sense quotient.

\*p < 0.05; \*\*p < 0.01 compared to Frontal Group.

2. Negative correlation between math anxiety and the percentage of improvement at T2 in NSq in the Parietal Group

