The effects of a preventive reading intervention on cognitive-linguistic skills in pre-readers at risk for dyslexia

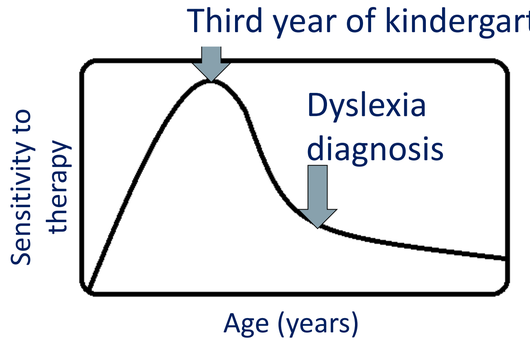
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1. What & why

Background:

Third year of kindergarten and first grade [1]



= "Dyslexia paradox"

- Intervention needs to be offered earlier to tackle the dyslexia paradox [2]
- **GraphoGame** already revealed positive effects on early literacy skills, reading accuracy, reading fluency and spelling abilities in diverse language contexts as well as in diverse age groups [3]

Present study:

- Investigation of the effects of GraphoGame on early literacy skills in Dutch-speaking pre-reading kindergartners at cognitive risk for dyslexia
  - **RQ 1**: Does GraphoGame improve letter knowledge (LK) more than an active control game or no intervention?
  - **RQ 2**: Does GraphoGame improve phonological awareness (PA) more than an active control game or no intervention?

2. Method

PRE-POST INTERVENTION DESIGN

Participants:

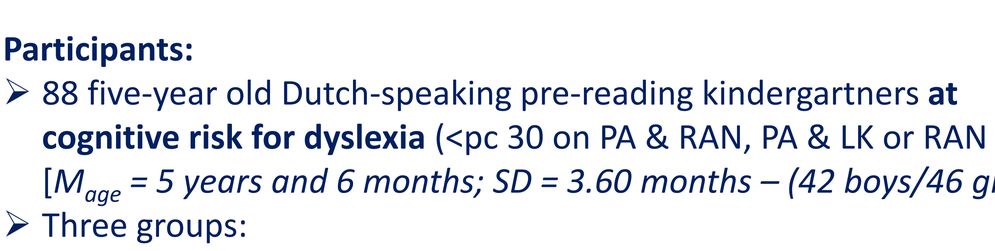
- 88 five-year old Dutch-speaking pre-reading kindergartners **at cognitive risk for dyslexia** (<pc 30 on PA & RAN, PA & LK or RAN & LK) [M_{age} = *5 years and 6 months; SD = 3.60 months – (42 boys/46 girls)]*
- Three groups:

GraphoGame[a] group (GG)[b]	Active control group (AC)[b]	Passive control group (PC)
n = 31	n = 29	n = 28
Flemish version of GG	Lego/Playmobil apps	No intervention

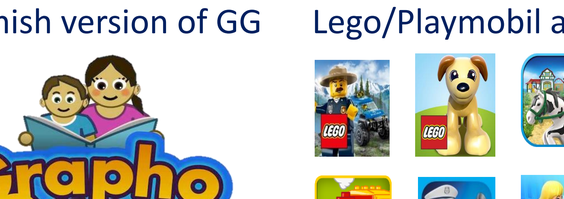
[a]Flemish version was based on the existing Dutch GG version but was adjusted to pre-readers (e.g. more letter knowledge and PA tasks) [4]
[b] GG and AC group also received a game-based auditory story-intervention on top of GG within the framework of another research question

Procedure:

- Tablet game-based intervention <u>at home</u>
  - GG and AC: 12 weeks, six days per week, 15 minutes per day



- Pre- and post-intervention test battery <u>at school</u>
  - Productive LK (paper-pencil task) [5]
  - Receptive LK (tablet-based assessment)
  - PA: end phoneme identification task (tablet-based assessment)
  - Tablet-based assessments via Diesel-X [6]

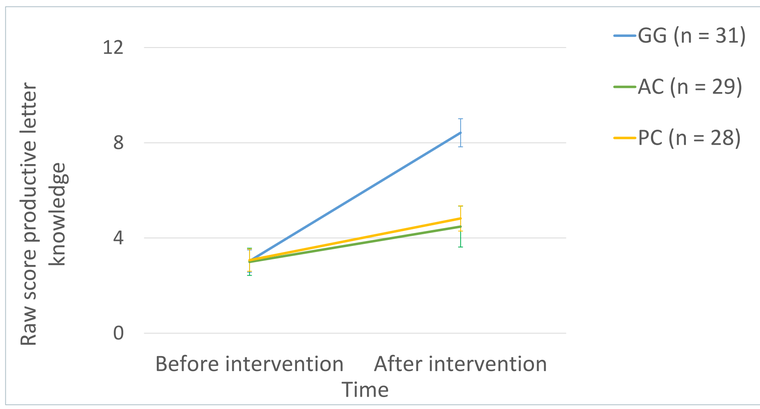


3. Preliminary Results

- Group characteristics and differences measured with Kruskal-Wallis test

Variable	GG	AC	PC	*p-value*
	MED	*MED*	*MED*	
Non-verbal IQ	101.88	95.50	94.92	p = .327
Age (months)	65.00	65.00	68.00	p = .05
Overall intervention hours	16.01	17.27	/	p = .57

- Repeated measures ANOVA (predictors: time point and group) for RQ 1 & 2
  - RQ 1: dependent variable: **<u>productive letter knowledge</u>**



Main effect of Group
$F_{(2,85)}$ = 3.93, p = .02
Main effect of Time
$F_{(1,85)}$ = 133.47, p < .001
Interaction effect
$F_{(2,85)}$ = 26.40, p < .001

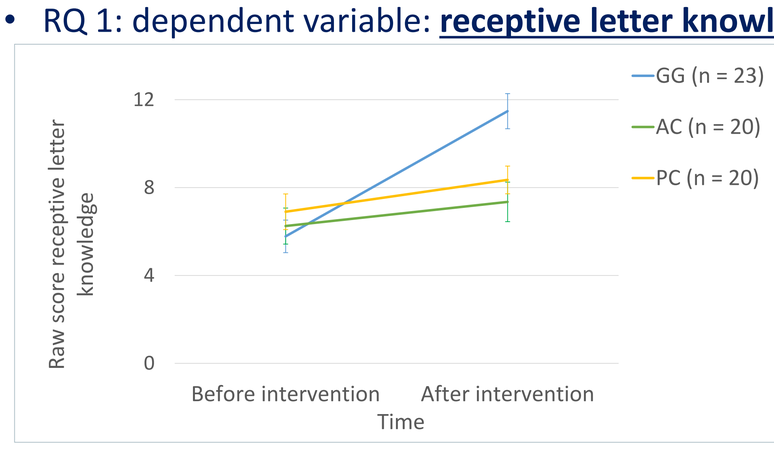
Figure displays mean and standard errors of mean for different groups

Post-hoc pairwise comparisons of the interaction effect[a]

Pre-test comparisons		Post-test comparisons	
GG $_{pre}$ – AC $_{pre}$	p = 1.00	GG $_{post}$ – AC $_{post}$	p < .001
GG $_{pre}$ – PC $_{pre}$	p = 1.00	GG $_{post}$ – PC $_{post}$	p = .001
AC $_{pre}$ – PC $_{pre}$	p = 1.00	AC $_{post}$ – PC $_{post}$	p = 1.00

[a]adjusted for multiple comparisons: Bonferroni

- RQ 1: dependent variable: **<u>receptive letter knowledge</u>**



No main effect of Group
$F_{(2,60)}$ = 2.04, p = .14
Main effect of Time
$F_{(1,60)}$ = 28.50, p < .001
Interaction effect
$F_{(2,60)}$ = 8.62, p = .001

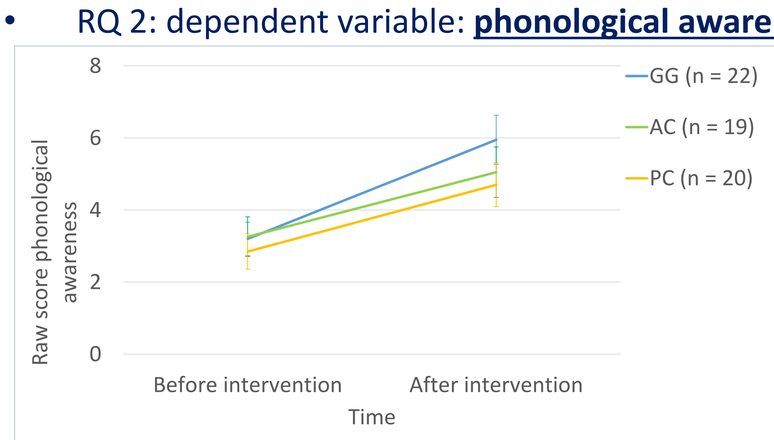
Figure displays mean and standard errors of mean for different groups

Post-hoc pairwise comparisons of the interaction effect[a]

Pre-test comparisons		Post-test comparisons	
GG $_{pre}$ – AC $_{pre}$	p = 1.00	GG $_{post}$ – AC $_{post}$	p .001
GG $_{pre}$ – PC $_{pre}$	p = .94	GG $_{post}$ – PC $_{post}$	p = .019
AC $_{pre}$ – PC $_{pre}$	p = 1.00	AC $_{post}$ – PC $_{post}$	p = 1.00

[a]adjusted for multiple comparisons: Bonferroni

- RQ 2: dependent variable: **<u>phonological awareness</u>**



No main effect of Group
$F_{(2,58)}$ = 0.68, p = .51
Main effect of Time
$F_{(1,58)}$ = 33.17, p < .001
No interaction effect
$F_{(2,58)}$ = 0.76, p = .47

Figure displays mean and standard errors of mean for different groups

4. Take home messages

- The GraphoGame group improved more with regard to LK compared to the active and passive control group, without showing a larger effect on PA
- Follow-up needed to investigate the effects of GraphoGame on actual reading and spelling measures in first grade

[1] Wanzek, J. ;, & Vaughn, S. (2007). Research-based implications from extensive early reading interventions. *School Psychology Review*, *36*(4), 541–561.
[2] Ozernov-Palchik, O., & Gaab, N. (2016). Tackling the "dyslexia paradox": Reading brain and behavior for early markers of developmental dyslexia. *Wiley Interdisciplinary Reviews: Cognitive Science*, *7*, 156–176. https://doi.org/10.1002/wcs.1383
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[5] Boets, B., De Smedt, B., Cleuren, L., Vandewalle, E., Wouters, J., & Ghesquière, P. (2010). Towards a further characterization of phonological and literacy problems in Dutch-speaking children with dyslexia. *British Journal of Developmental Psychology*, *28*(1), 5–31. https://doi.org/10.1348/026151010X485223
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