



FACULTY OF PSYCHOLOGY
UNIVERSITY OF WARSAW



Connections between phonological awareness, poor reading and poor oral language in early school-age children: results from an (almost) transparent orthography

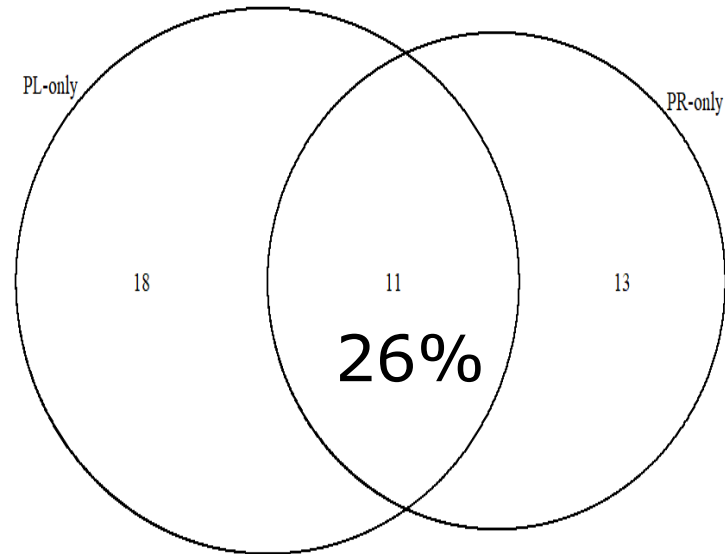
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Poor oral language and/or poor reading

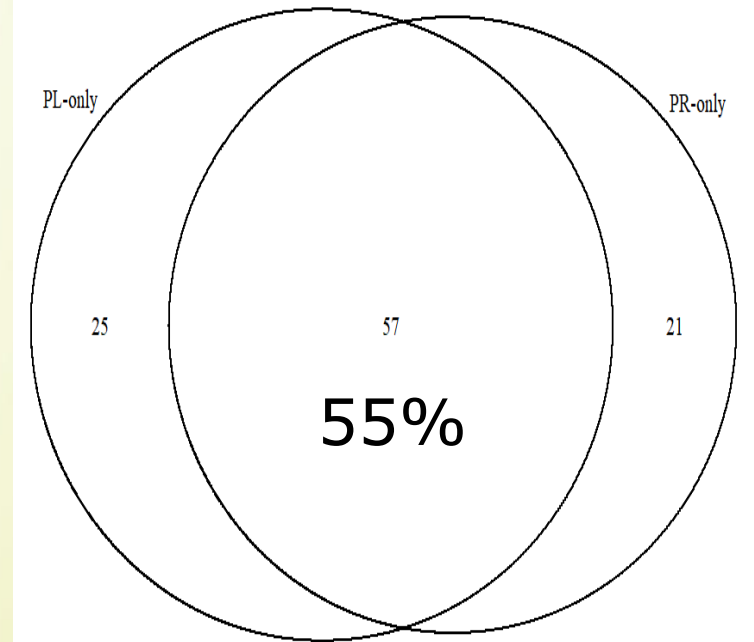
Poor oral language (PL) = low results in tasks measuring vocabulary and/or grammar production and/or comprehension

Poor reading (PR) = low results in tasks measuring accuracy and/or speed of word and pseudoword reading

Poor language and/or poor reading



Rakhlin et al., 2013



Eisenmajer et al., 2005

Phonological awareness

- ▶ **Phonological awareness (PA) is the ability to explicitly distinguish, identify, and manipulate phonological segments of speech (i.e., syllables, onsets-rimes, phonemes). It is measured with tasks such as creating rhymes, alliterations, phoneme/syllable elision, segmentation, and blending (Dębska et al., 2016; Swanson et al., 2003).**
- ▶ **Meta-analysis: dyslexia vs age-matched controls: $d = -1.37$ (Melby-Lervåg et al., 2012)**

Poor oral language and/or poor reading

Table 6

Dyslexic Cases in CLDRC: Cross-Tabulation of Overall Model Fit, Based on the "Counting Deficits" and the Individual Regression Fit Methods Applied to Individual Cases

	Deficit	PA only	L only	PS/NS only	PA and L	PA and PS/NS	L and PS/NS	PA, L, & PS/NS	None	Total
Best-fitting model	PA	11	0	0	1	7	0	3	8	30
	L	0	5	0	1	0	1	2	1	10
	PS/NS	0	0	4	0	0	4	1	4	13
	Multiple	3	3	1	2	6	1	9	5	30
	Total	14	8	5	4	13	6	15	18	83

Note. CLDRC = Colorado Learning Disabilities Research Center; PA = phoneme awareness; L = language skill; PS = processing speed; NS = naming speed.

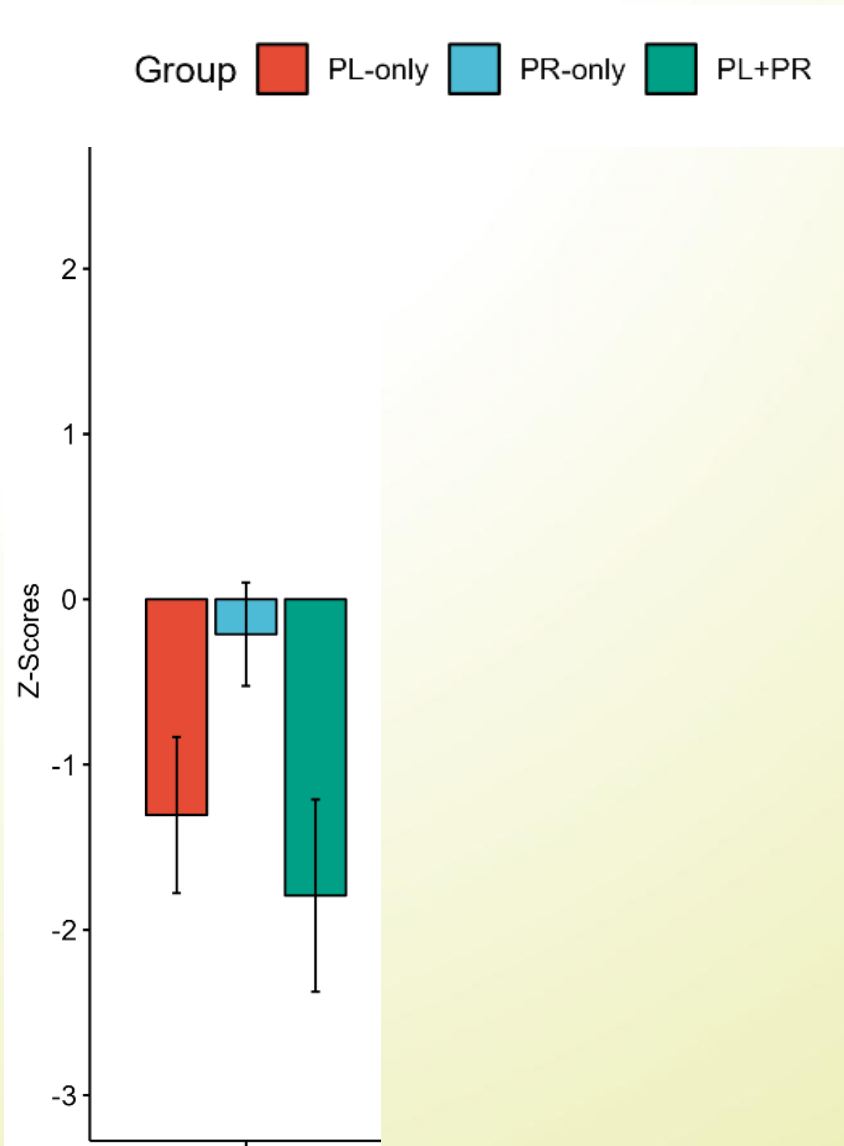
Penninton et al., 2012



Our analysis

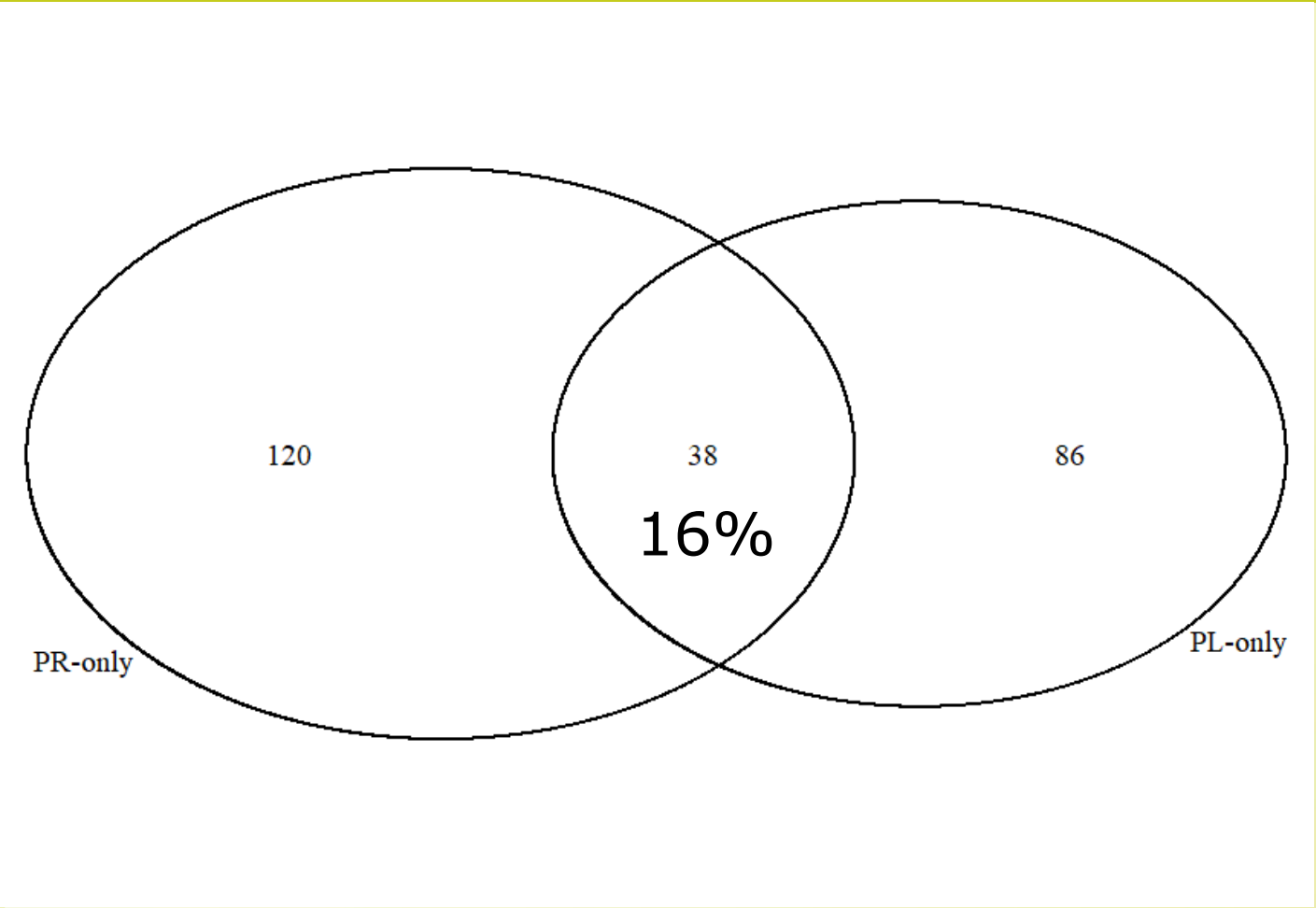


Hypotheses



- ▶ Language tests: PR-only > PL-only and PL+PR
- ▶ Reading tests: PL-only > PR-only and PL+PR
- ▶ Phonological awareness:
 - ▶ PL-only and PR-only > PL+PR
 - ▶ PL-only: elision deficits
 - ▶ PR-only: blending, segmenting deficits

Our analysis: how often PL and PR skills co-occur in Polish?



Our analysis: participants ($n = 38$ in each group)

	TD	PL-only	PR-only	PL+PR	
Age	94.66 (4.40)	94.74 (3.66)	94.53 (4.76)	94.39 (4.49)	TD = PL-only = PR-only = PL+PR
Parental's education	5 (1)	5 (1)	5 (1)	5 (1)	TD = PL-only = PR-only = PL+PR
Nonverbal IQ	97.29 (10.07)	93.87 (10.44)	97.92 (10.74)	95.53 (10.48)	TD = PL-only = PR-only = PL+PR
Language	5.7 (.94)	3.78 (.59)	5.59 (.93)	3.59 (1.29)	(TD = PR-only) > (PL-only = PL+PR)
Reading	5.78 (.96)	5.28 (1.25)	3.05 (.84)	2.95 (.80)	(TD = PL-only) > (PR-only = PL+PR)

Note. TD – typically developing, PL-only – children with poor oral language, PR-only – poor readers, PL+PR – children with poor oral language and poor reading skills, Age in months: mean (SD). Parent’s education level on an ordinal scale (1--8): median (interquartile range). Nonverbal IQ on the Wechsler scale ($M = 100$, $SD = 15$). Language and Reading – a mean sten result of all sub-tests ($M = 5.5$, $SD = 2$). ‘=’ -- a comparison that is not significantly different at $p > .05$. ‘>’ – groups significantly different from each other, $p < .001$.

Our analysis: measures and procedures

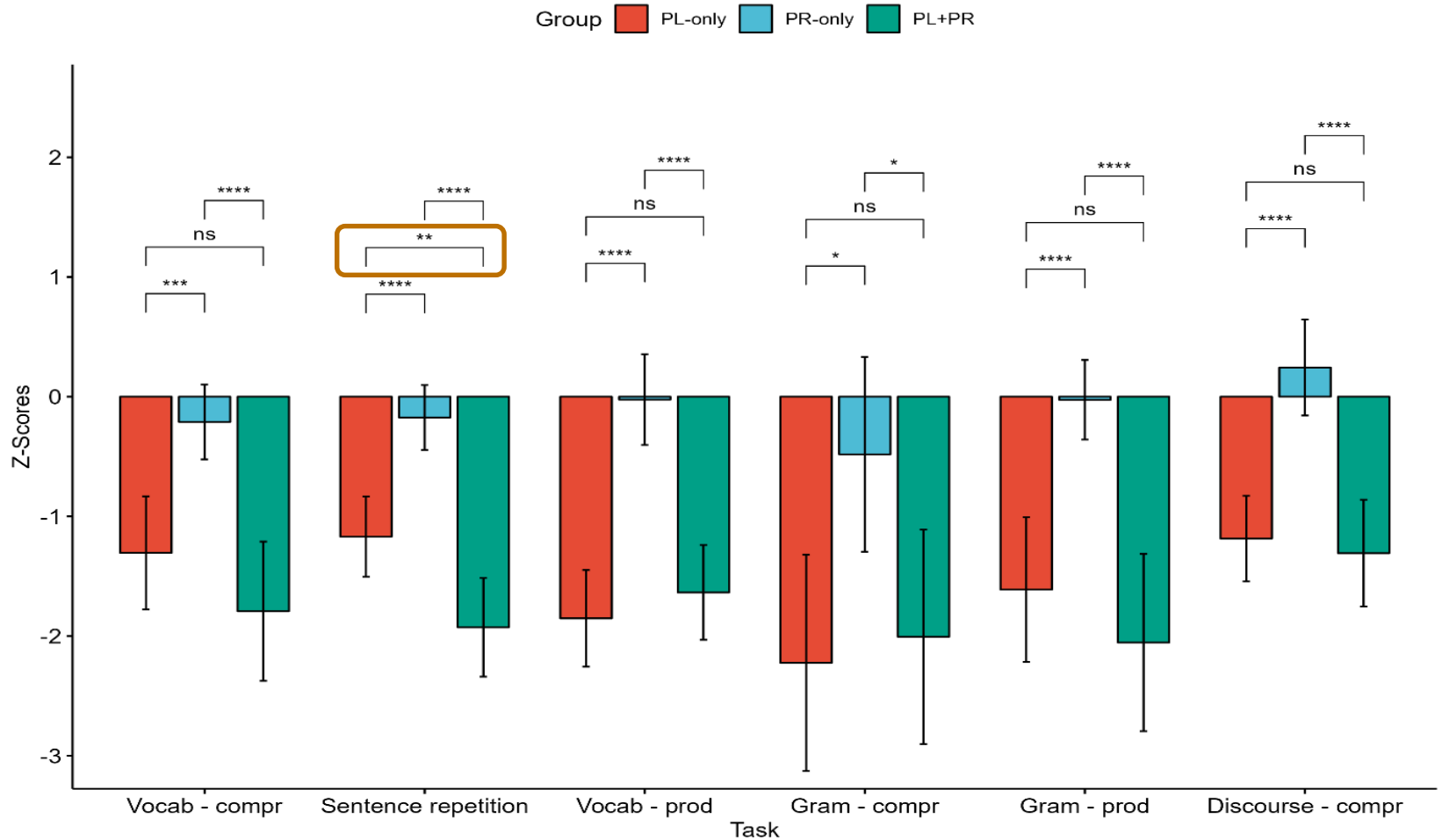
- ▶ **Reading skills:** Letter naming, Timed word reading, Pseudoword reading, Timed pseudoword reading
- ▶ **Language:** Vocabulary – comprehension, Vocabulary – production, Sentence repetition, Grammar – comprehension, Grammar – production, and Discourse – comprehension.
- ▶ **Phonological awareness:**

Principal Component Analysis of Battery of Phonological Tests

Sub-test	Principal component		
	(1)Elision	(2)Blending phonemes	(3)Segmenting syllables
F_10: Syllable elision - words to pseudowords	.784	.035	.316
F_14: Phoneme elision - words	.778	.223	.229
F_9: Syllable elision - words	.774	.088	.294
F_2: Alliteration - pseudowords	.607	.070	.061
F_3: Alliteration - fluency	.487	.324	-.180
F_1: Phoneme discrimination	.438	.209	.337
F_5: Rime - fluency	.408	.288	.086
F_11: Phoneme blending - words	.113	.863	.069
F_12: Phoneme blending - pseudowords	.162	.804	.261
F_6: Syllable blending - pseudowords	.347	.381	.366
F_7: Syllable segmentation - words	.095	.064	.800
F_8: Syllable segmentation - pseudowords	.248	.196	.753

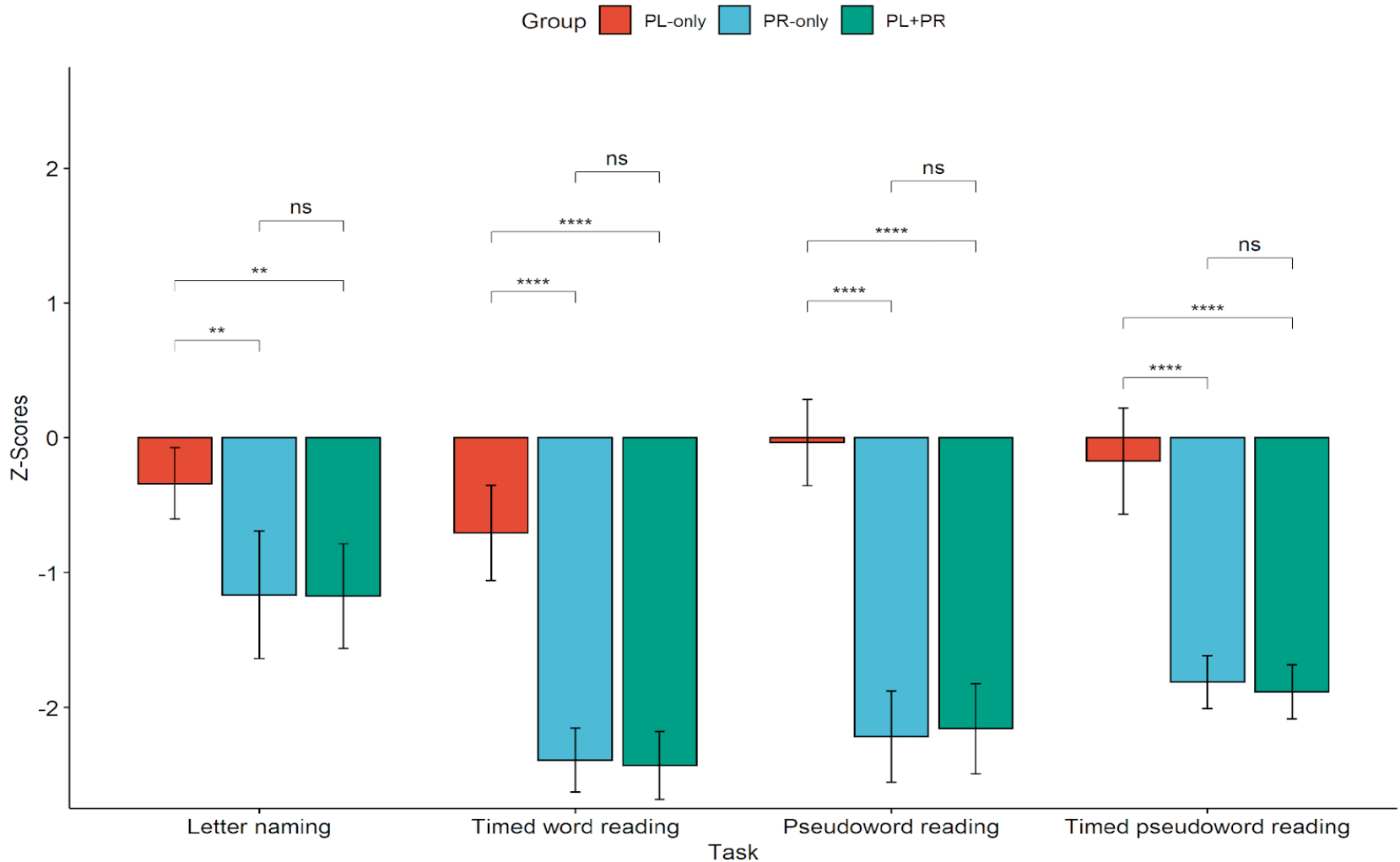
Note. $N = 962$. The extraction method was a principal component analysis with an orthogonal (Varimax with Kaiser normalization) rotation. Factor loadings above .70 are in bold.

Results: between-group differences in Language



Note. PL-only – children with poor oral language, PR-only – poor readers, PL+PR – children with poor oral language and poor reading skills, Between-group differences as Z-Scores' results of six Language sub-tests (Vocabulary – comprehension, Sentence repetition, Vocabulary – production, Grammar – comprehension, Grammar – production, and Discourse comprehension). Error bars indicate the 95% confidence intervals. All p-values are Holm–Bonferroni adjusted. Typically developing group: Mean = 0, SD = 1. * $p < .05$. ** $p < .01$. *** $p < .001$ **** $p < .0001$

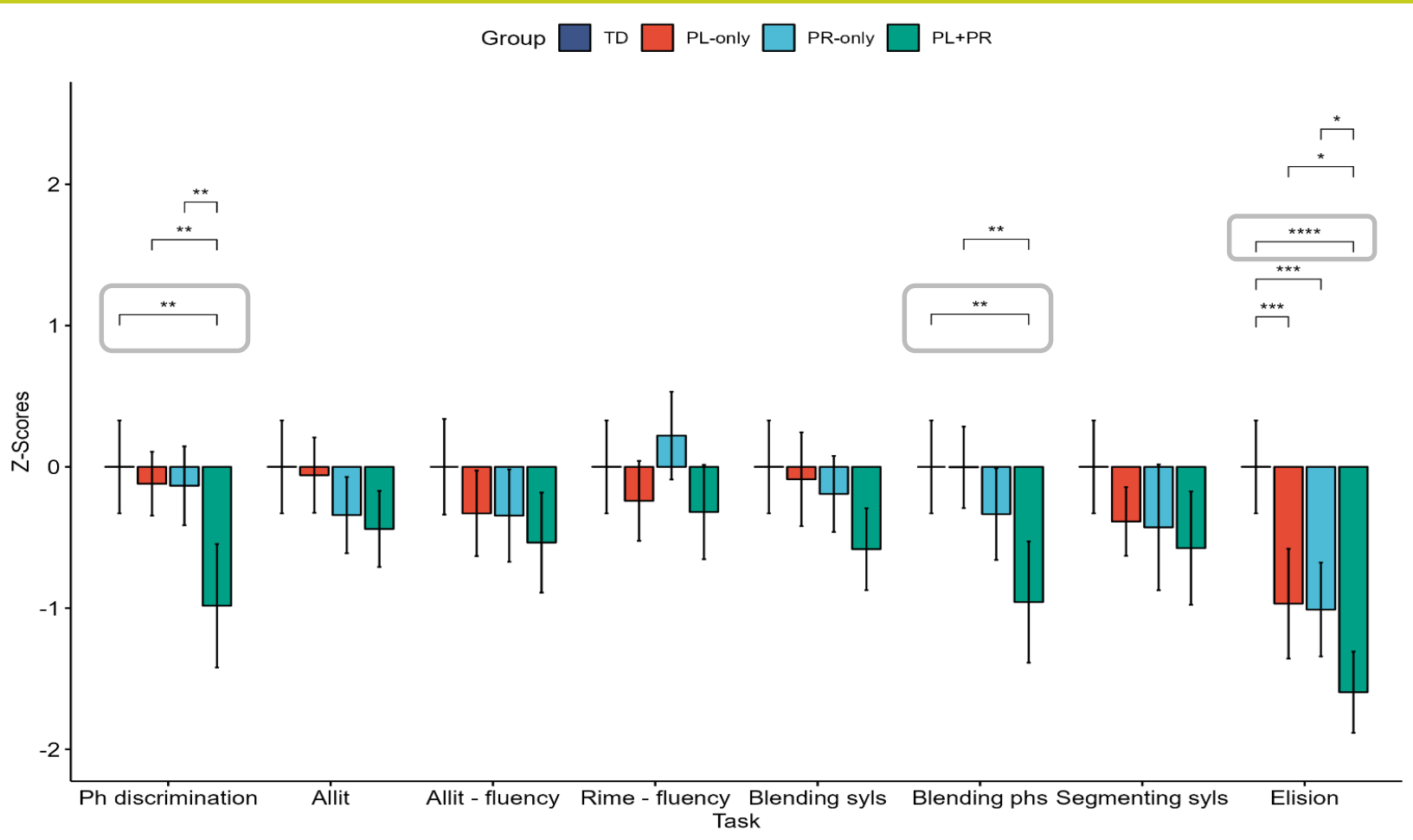
Results: between-group differences in Reading



Note. PL-only – children with poor oral language, PR-only – poor readers, PL+PR – children with poor oral language and poor reading skills, Between-group differences as Z-Scores' results for four Reading sub-tests. Error bars indicate the 95% confidence intervals. All p-values are Holm–Bonferroni adjusted. Typically developing group: Mean = 0, SD = 1. * $p < .05$. ** $p < .01$. *** $p < .001$ **** $p < .0001$



Results: between-group differences in Phonological awareness



Note. PL-only – children with poor oral language, PR-only – poor readers, PL+PR – children with poor oral language and poor reading skills. Between-group differences as Z-Scores' results for PA sub-tests (Phoneme discrimination, Alliteration – pseudowords, Alliteration – fluency, Rime – fluency, Blending syllables – pseudowords, Blending phonemes factor, Segmenting syllables factor, Elision factor). Error bars indicate the 95% confidence intervals. All p-values are Holm–Bonferroni adjusted. Typically developing group: Mean = 0, SD = 1. * $p < .05$. ** $p < .01$. *** $p < .001$. **** $p < .0001$

Multiple case study: Distribution of deficits in cognitive-linguistic skills (% of participants) within groups

	None		Single deficit			Multiple deficits				
	None	PA	RAN	NWR	Total single	PA+ RAN	PA+ NWR	RAN+ NWR	PA+RAN+ NWR	Total multiple
-1.65 SD threshold										
TD	47.4	28.9	7.9	7.9	44.7	0.0	7.9	0.0	0.0	7.9
PL-only	36.8	26.3	5.3	5.3	36.8	13.2	5.3	5.3	2.6	26.3
PR-only	26.3	15.8	26.3	0.0	42.1	26.3	0.0	0.0	5.3	31.6
PL+PR	2.6	23.7	5.3	7.9	36.8	42.1	5.3	5.3	7.9	60.5
-1 SD threshold										
TD	18.4	42.1	13.2	0.0	55.3	5.3	15.8	2.6	2.6	26.3
PL-only	15.8	34.2	2.6	2.6	39.5	15.8	13.2	0.0	15.8	44.7
PR-only	7.9	18.4	15.8	0.0	34.2	42.1	0.0	0.0	15.8	57.9
PL+PR	2.6	7.9	0.0	0.0	7.9	31.6	18.4	0.0	39.5	89.5

Note. N= 152. TD – typically developing, PL-only – children with poor oral language, PR-only – poor readers, PL+PR – children with poor oral language and poor reading skills, PA – a deficit in any of PA tasks or factors, RAN – a deficit in either RANletters or RANdigits, NWR – a deficit in a NWR_{Low Wordlikeness} or NWR_{High Wordlikeness}



Conclusions

Literature

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- ▶ Eisenmajer, N., Ross, N., & Pratt, C. (2005). Specificity and characteristics of learning disabilities. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *46*(10), 1108–1115.
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- ▶ Melby-Lervåg, M., Lyster, S. A. H., & Hulme, C. (2012). Phonological skills and their role in learning to read: A meta-analytic review. *Psychological Bulletin*, *138*(2), 322–352.
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- ▶ Pennington, B. F., Santerre-Lemmon, L., Rosenberg, J., Macdonald, B., Boada, R., Friend, A., Leopold, D. R., Samuelsson, S., Byrne, B., Willcutt, F. G., & Olson, R. K. (2012). Individual Prediction of Dyslexia by Single Versus Multiple Deficit Models. *Journal of Abnormal Psychology*, *121*(1), 212–224.
- ▶ Rakhlin, N., Cardoso-Martins, C., Kornilov, S. A., & Grigorenko, E. L. (2013). Spelling well despite developmental language disorder: What makes it possible? *Annals of Dyslexia*, *63*(3–4), 253–273.
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