

A meta-analytic review on early mathematical interventions for multilingual children – Preliminary results

Katri Luomaniemi, Andreas Gegenfurtner, Sanni Kankaanpää, Jake McMullen and Minna Hannula-Sormunen

TOPIC & METHOD

BACKGROUND: Low proficiency in the language of instruction seems to be associated with lower achievement in mathematics (OECD, 2016). According to research-based recommendations (for review, see Luomaniemi et al. 2023), multilingual children's early mathematical skills can be supported by (a) using children's home language, (b) focusing on mathematical language and (c) using culturally responsive instructional approach.

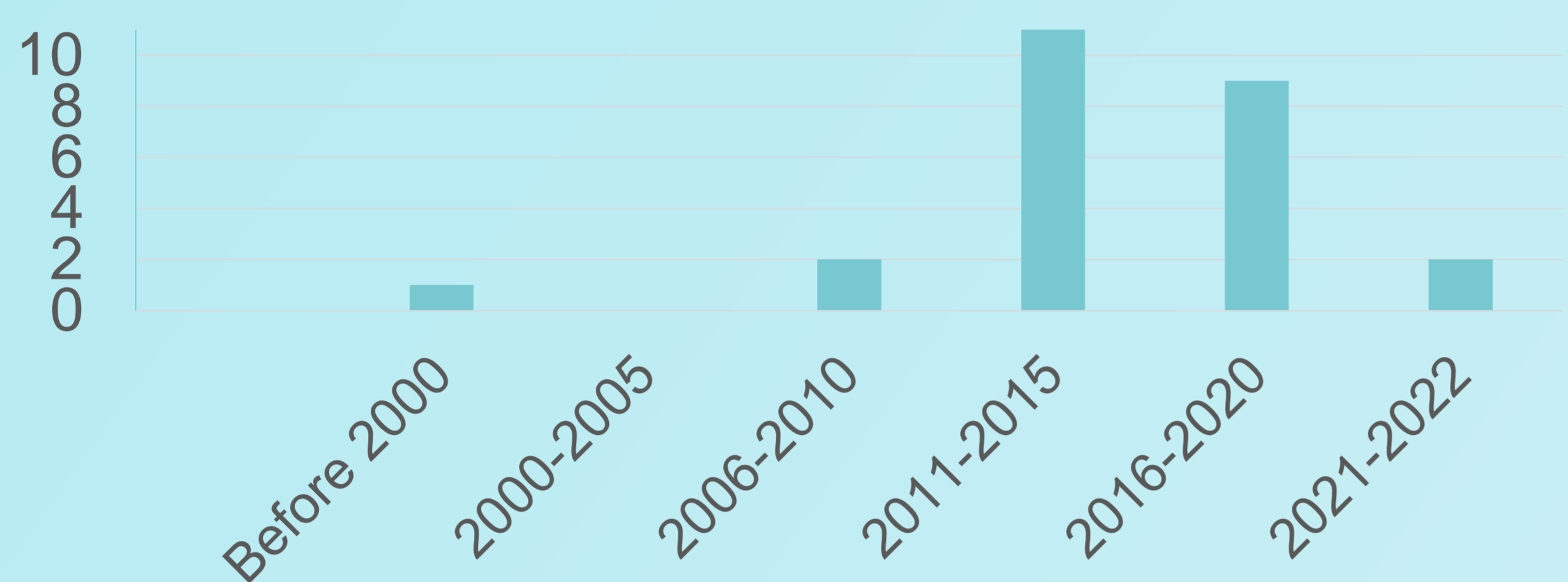
AIMS: (1) To systematically review early mathematical intervention studies for multilingual children. We will focus on the study features, mathematical content and the recommended practices (a - c) embedded in the interventions.
(2) To examine how effective the interventions were on children's mathematical skills.

INCLUSION CRITERIA:

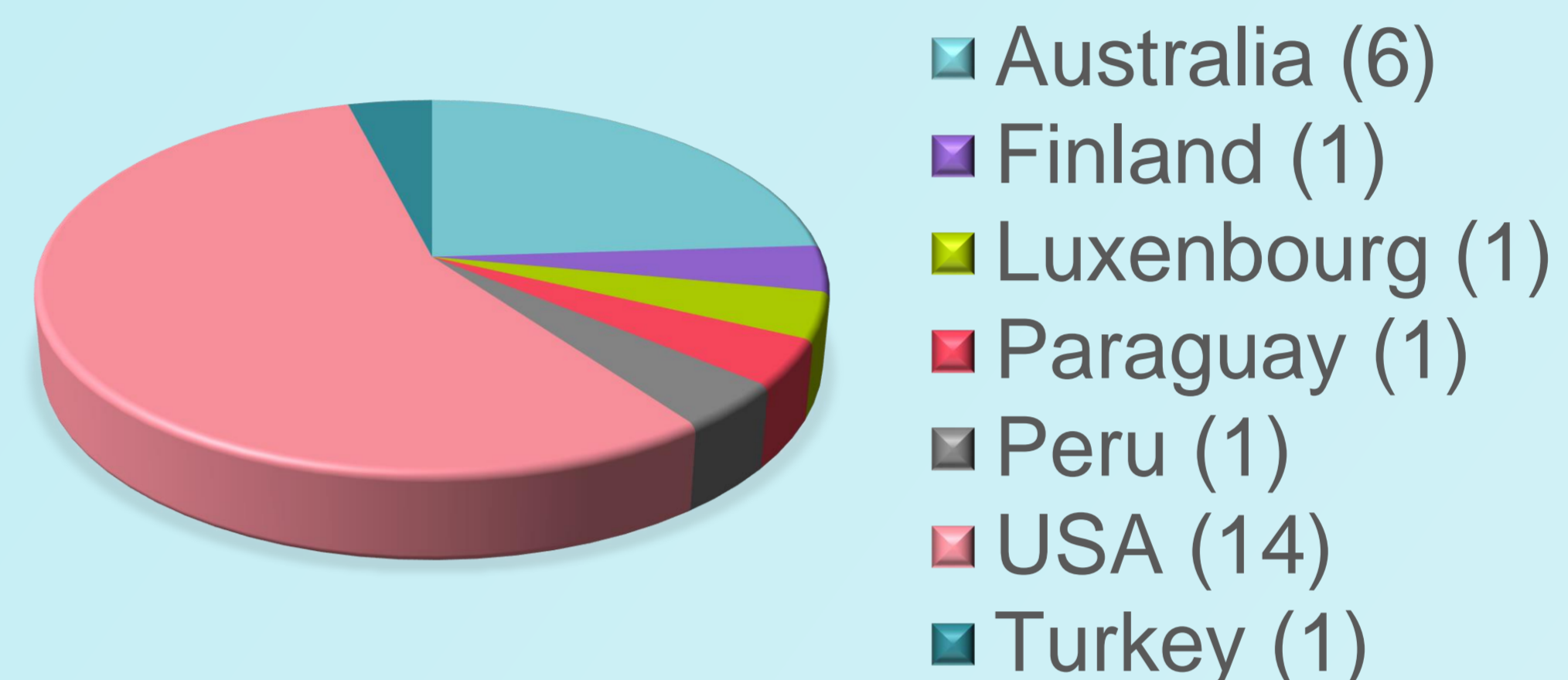
- For the systematic review
- ✓ Participants 3–5-year old multilingual children
 - ✓ Early mathematical intervention
 - ✓ Math outcome measure
- For the meta-analysis
- ✓ Multilingual control group
 - ✓ Adequate data for effect size calculation

PRELIMINARY RESULTS – SYSTEMATIC REVIEW

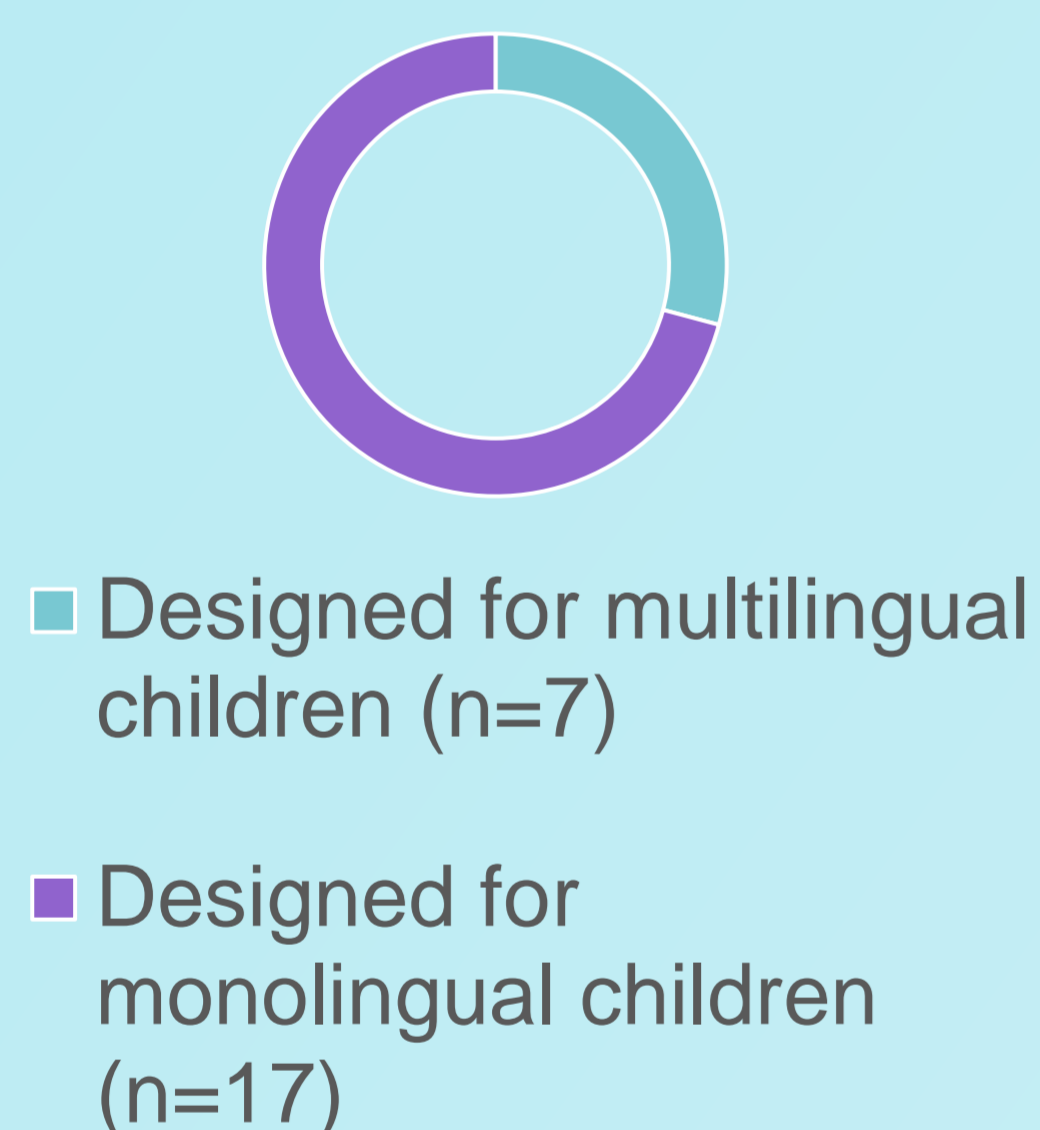
PUBLICATION YEARS OF THE STUDIES (N=25)



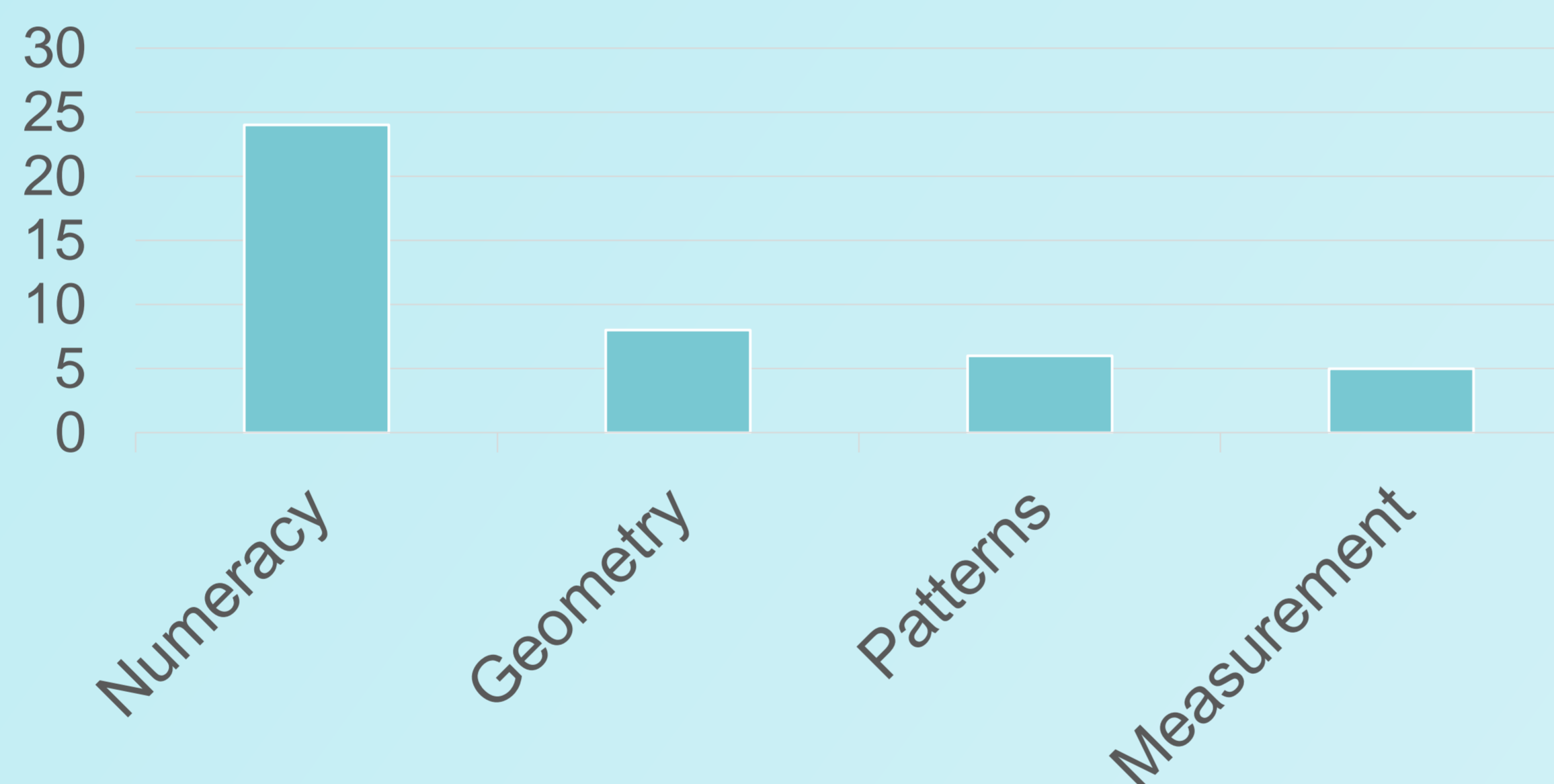
STUDY LOCATION



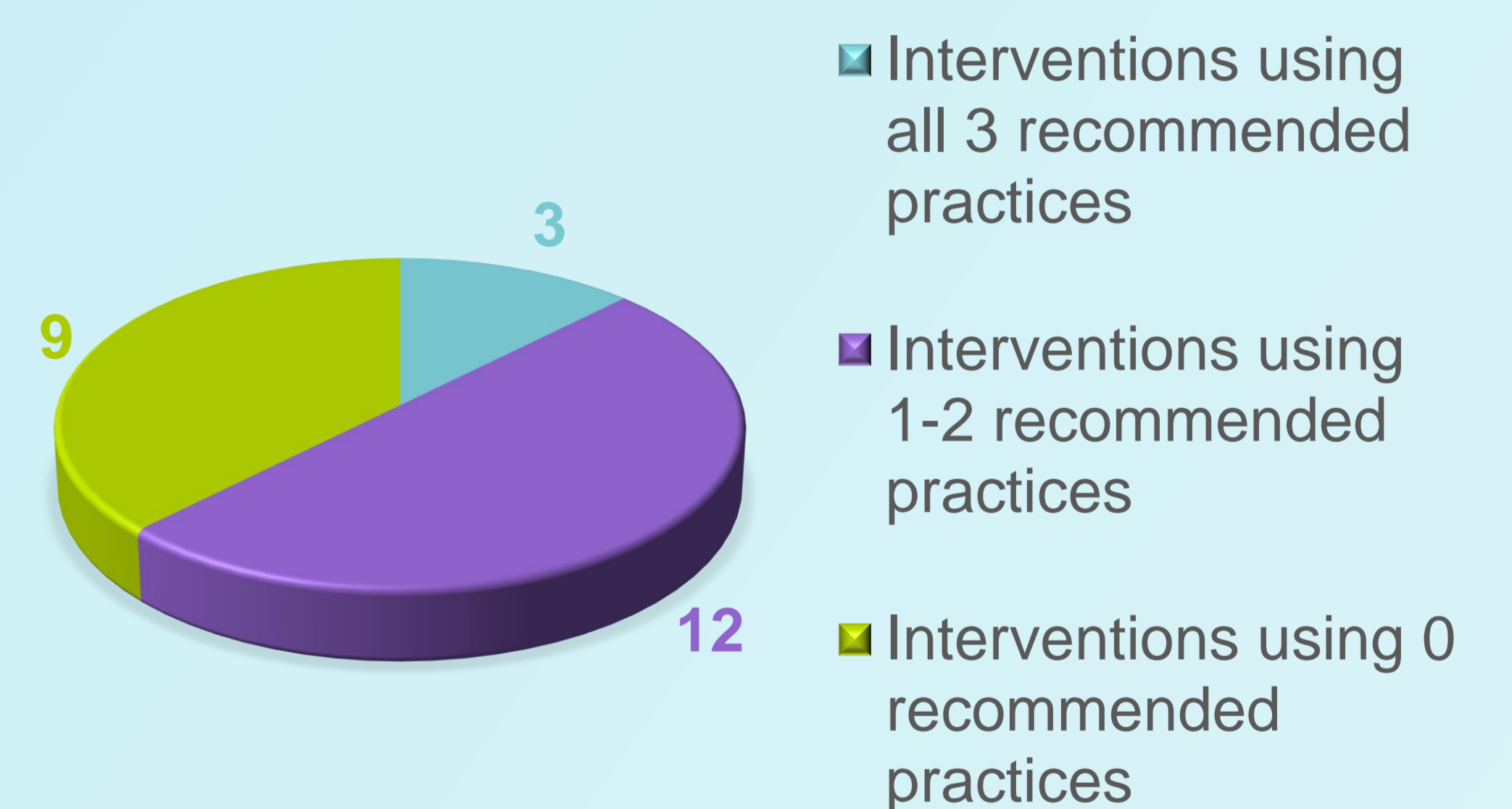
INTERVENTION DESIGN N=24



MOST INVESTIGATED MATHEMATICAL DOMAINS IN THE INTERVENTIONS



USE OF A) HOME LANGUAGE, B) MATHEMATICAL LANGUAGE AND C) CULTURALLY RESPONSIVE INSTRUCTIONAL APPROACH



PRELIMINARY RESULTS – META-ANALYSIS

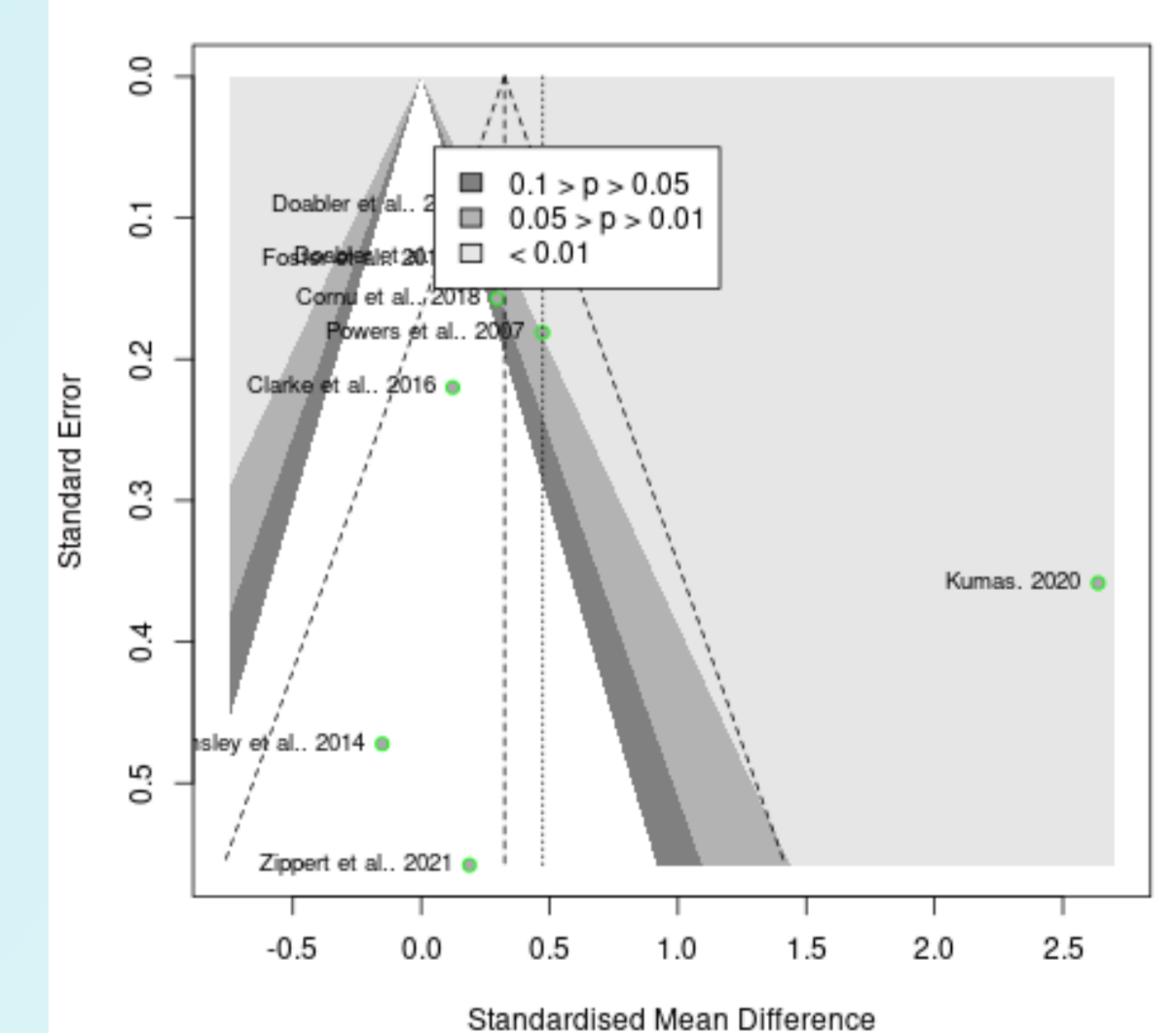
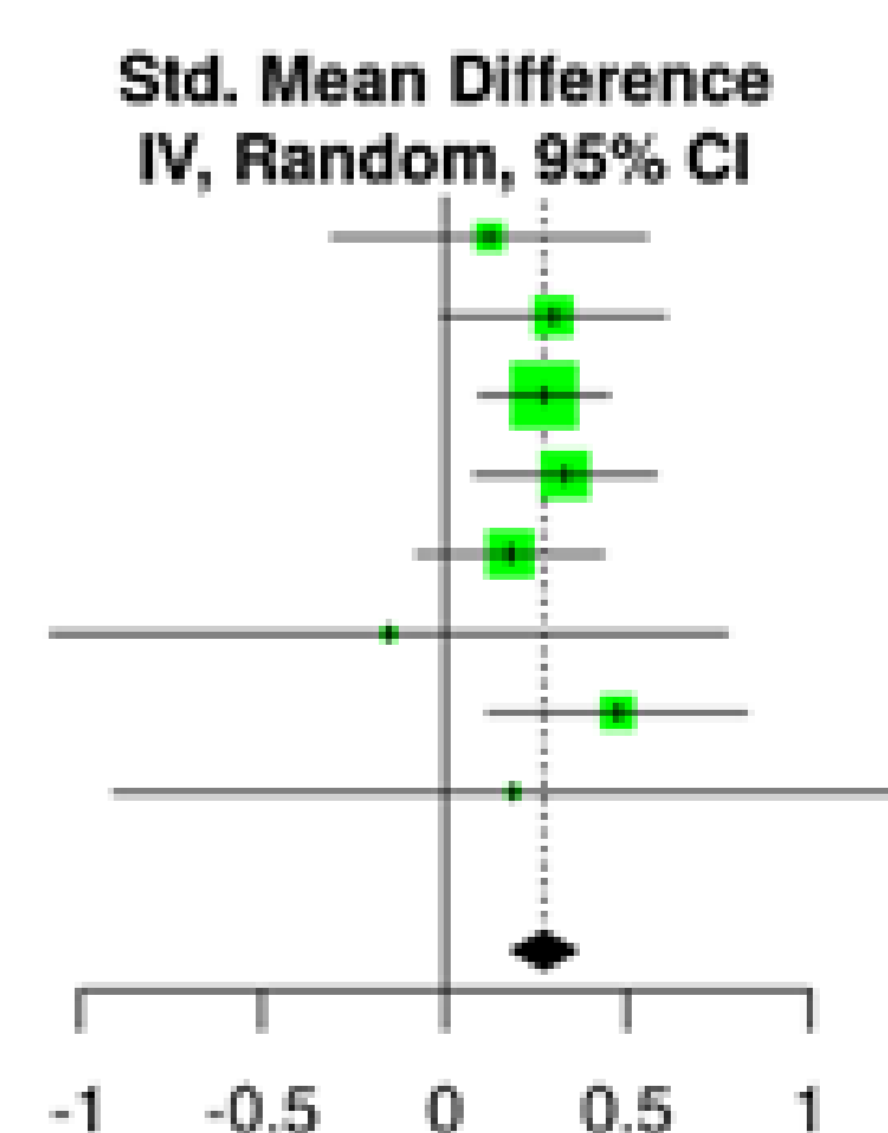
9 studies included.

The average weighted effect size with one outlier removed was small:

$g = 0.27$,
95 % CI = 0.18, 0.36

Study	Experimental			Control			Weight	Std. Mean Difference IV, Random, 95% CI
	Mean	SD	Total	Mean	SD	Total		
Clarke et al., 2016	83.15	9.1700	47	81.89	11.3200	37	6.1%	0.12 [-0.31; 0.55]
Cornu et al., 2018	6.63	4.0400	80	5.51	3.4600	84	11.9%	0.30 [-0.01; 0.60]
Doabler et al., 2016	93.90	13.4000	292	90.30	13.0000	211	35.6%	0.27 [0.09; 0.45]
Doabler et al., 2019	23.70	7.6000	188	21.20	7.5000	94	18.1%	0.33 [0.08; 0.58]
Foster et al., 2018	20.80	8.0100	116	19.39	7.6600	120	17.2%	0.18 [-0.08; 0.44]
Hemsley et al., 2014	28.30	3.8000	9	29.00	4.9000	9	1.3%	-0.15 [-1.08; 0.77]
Powers et al., 2007	57.90	20.8400	71	48.43	18.6400	56	8.9%	0.47 [0.12; 0.83]
Zippert et al., 2021	0.46	2.4400	6	0.08	1.2300	7	0.9%	0.19 [-0.91; 1.28]
Total (95% CI)			809			618	100.0%	0.27 [0.18; 0.36]

Heterogeneity: $\tau^2 = 0$; $\chi^2 = 3.25$, $df = 7$ ($P = 0.86$); $I^2 = 0\%$



EDUCATIONAL IMPLICATIONS

Further mathematical intervention studies specifically designed for young multilingual children are needed.

Ideas for future:

- ✓ Designing an intervention specifically for multilingual children utilizing research-based recommendations
- ✓ Implementing an online course for ECEC professionals with evidence-based mathematical activities and information on how to support multilingual children's mathematical skills in early childhood education.

REFERENCES: OECD. (2016) Immigrant background, student performance and students' attitudes towards science, in *PISA 2015 Results (Volume I): Excellence and Equity in Education*, (pp. 241–262). OECD Publishing, Paris.

Luomaniemi et al. (2023). Recommendations for supporting multilingual children's early mathematical skills - A thematic synthesis. *Journal of Early Childhood Education Research*. 12(3), 23–63.

ACKNOWLEDGEMENTS: Academy of Finland, FONO project Grant 331772



UNIVERSITY OF TURKU



Universität Augsburg University