

## Abstract PAEPSY 2021

**Title:** Meta-Analytic Structural Equation Models of Executive Functions and Math Intelligence in Preschool Children

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### Abstract

**BACKGROUND:** Response inhibition, attention shifting, and working memory updating are the three core executive functions (EFs; Miyake et al., 2000) underlying other cognitive skills that are relevant for learning and everyday life. For example, they have shown to be differentially related to the mathematical component of intelligence (i.e., math intelligence) in school students and adults. While researchers suppose these three EFs to become more differentiated from early childhood to adulthood, neither the link of these constructs nor their structure has been conclusively established in preschool children yet. Primary studies on path models connecting EFs and math intelligence diverge in the exact relation of EFs and math intelligence. It remains unclear whether inhibition, shifting, and updating exhibit distinct but correlated constructs with respect to their relation to math intelligence.

**OBJECTIVES:** With our meta-analysis, we aimed to (a) synthesize the relation between the three EFs and math intelligence in preschool children; and (b) compare plausible models of the effects of EFs on math intelligence.

**METHODS/RESULTS:** Synthesizing data from 47 studies (363 effect sizes, 30,481 participants) from the last two decades via novel multilevel and multivariate meta-analytic models (Pustejovsky & Tipton, 2020), we found the three core EFs to be significantly related to math intelligence: Inhibition ( $\bar{r} = .30$ , 95 % CI [.25, .35]), shifting ( $\bar{r} = .32$ , 95 % CI [.25, .38]), and updating ( $\bar{r} = .36$ , 95 % CI [.31, .40]). Looking at the three core EFs as one construct, the correlation was  $\bar{r} = .34$ , 95 % CI [.31, .37]. Utilizing correlation-based, meta-analytic structural equation modeling (Jak & Cheung, 2020), our results exhibited significant relations of all EFs to math intelligence. These relations did not differ between the three core EFs.

**DISCUSSION:** Our findings corroborate the positive link between EFs and math intelligence in preschool children and are similar to other age groups. From the model testing, we learned that representing EFs by a latent variable, thus capturing the covariance among the three core EFs, explained substantially more variation in math intelligence than representing them as distinct constructs.

**Literature:**

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