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Cognitive factors affecting children's nonsymbolic and symbolic magnitude judgment abilities: A latent profile analysis.

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Summary: Early math abilities are claimed to be linked to magnitude representation ability. Some claim that nonsymbolic magnitude abilities scaffold the acquisition of symbolic (Arabic number) magnitude abilities and influence math ability. Others claim that symbolic magnitude abilities, and ipso facto math abilities, are independent of nonsymbolic abilities and instead depend on the ability to process number symbols (e.g., 2, 7). Currently, the issue of whether symbolic abilities are or are not related to nonsymbolic abilities, and the cognitive factors associated with nonsymbolic-symbolic relationships, remains unresolved. We suggest that different nonsymbolic-symbolic relationships reside within the general magnitude ability distribution and that different cognitive abilities are likely associated with these different relationships. We further suggest that the different nonsymbolic-symbolic relationships and cognitive abilities in combination differentially predict math abilities. To test these claims, we used latent profile analysis to identify nonsymbolic-symbolic judgment patterns of 124, 5- to 7-year-olds. We also assessed four cognitive factors (visuospatial working memory (VSWM), naming numbers, nonverbal IQ, and basic reaction time (RT)) and two math abilities (number transcoding and single-digit addition abilities). Four nonsymbolic-symbolic ability profiles were identified. Naming numbers, VSWM, and basic RT abilities were differentially associated with the different ability profiles and in combination differentially predicted math abilities. Findings show that different patterns of nonsymbolic-symbolic magnitude abilities can be identified and suggest that an adequate account of math development should specify the inter-relationship between cognitive factors and nonsymbolic-symbolic ability patterns.

Classification: F21 F22 C31 C32 C41 C42

Keywords: nonsymbolic and symbolic ability patterns; visuospatial working memory; number naming ability; math ability differences; latent profile analysis; magnitude representation

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