Stability and change in patterns of preschool children's symbolic and non-symbolic magnitude judgment abilities (K-2): Implications for literacy and numeracy acquisition

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Research topic: Mathematical competencies are vital for modern life and have been linked to success in the workplace and in academia. Many studies indicate that preschool children's magnitude processing abilities (both symbolic and non-symbolic) are related to mathematical attainment in elementary school. However, the relationship between the symbolic and non-symbolic systems remains controversial. This is the focus of the present investigation.

Why is my study unique? This investigation will be the first study to examine (i) symbolic *and* non-symbolic magnitude estimation in a large representative sample of preschool children followed longitudinally from preschool (kindergarten in Israel) to 2nd grade, (ii) the discrepancies and dissociations between these two abilities, (iii) stability and change in these profiles, and (iv) the consequences for early math attainment in school.

Specific questions:

1)   Will children with different profiles based on magnitude comparison differ on linguistic, numerical, and attitudinal variables?

We assume that preschool children with a selectively lower non-symbolic profile will show higher scores in linguistic skills but weaker spatial working memory than the selectively low-symbolic subgroup. Based on previous studies, we also predict that the low-symbolic subgroup will experience greater math anxiety in elementary school.

2)   Will children with different profiles based on magnitude comparison differ in mathematical competence in kindergarten and in 1st grade?

We predict that children from the low-symbolic subgroup will have lower early mathematical attainment (1st and 2nd grades) compared to the low-non-symbolic subgroup.

3) Stability and change from preschool to 2nd grade.

To what extent do the subgroup profiles remain stable or change from preschool to 2nd grade? It is possible that the low-symbolic profile will not remain stable because the symbolic number system is taught in 1st grade.

Analyses currently underway: Some preliminary preschool findings are depicted in the adjacent figure. As predicted, the low-non-symbolic subgroup had superior scores in linguistic tasks, whereas the low-symbolic subgroup was superior in spatial working memory. The four subgroups also differed in their attitude to mathematics.
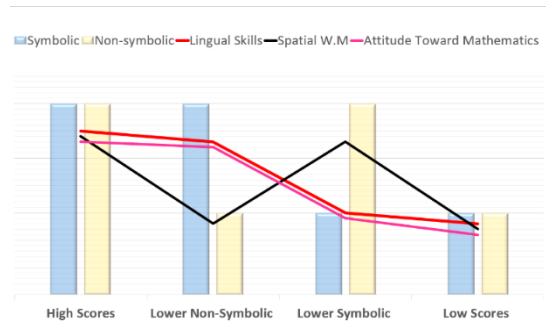
Significance of this study and relevance for education: The purpose of dividing children into subgroups highlights the uniqueness of each profile as well as the source of individual differences. Such analyses are likely to shed light on the mathematical learning process and on the optimal way to assist children with mathematical difficulties.