Executive functioning and children’s mathematical competence: from kindergarten to early adolescence

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To encourage coverage of mathematical skills deemed important for the acquisition of symbolic algebra, the National Council of Teachers of Mathematics has published curricular guidelines for kindergarten to grade-school classes. We conducted a cross-sectional study to examine children’s developing competencies in pre-algebra and the extent to which they are affected by executive functioning. In the first wave of a 5-year longitudinal project, we tested 630 children (5, 7, 9, vs. 11 year olds). Children were administered tests of updating capacity (two complex span and a modified running span tasks), inhibition efficiency (antisaccade, a modified flanker, and a modified Simon task), and switching efficiency (a cognitive switch task and measures from the switch condition of the inhibitory tasks). Subscales from the Wechsler Individual Achievement Test provided a baseline of children’s developing mathematical competence. Curriculum specific pre-algebraic items targeting children’s mathematical pattern recognition and word problem solving skills were also administered. Preliminary analysis on data from the three younger age groups shows reliable increases in updating capacity for each group. There were also decreases in inhibitory errors and a reduction in switch cost on the flanker and Simon tasks. Updating measures accounted for over 2/3 of variance in the standardised mathematics tasks; switching and inhibition explained additional but small amount of variance. Non-executive related age differences explained additional variance. Of particular interest was that variance attributable to updating did not vary by age. Further analyses suggest subtle differences in the relationship between executive functioning and different aspects of mathematical competence.