Precursors to Mathematical Skill:
The Relations Among Fine Motor Ability, Subitizing, and Early Math Skills

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Do fine motor ability and subitizing speed predict early math skills?

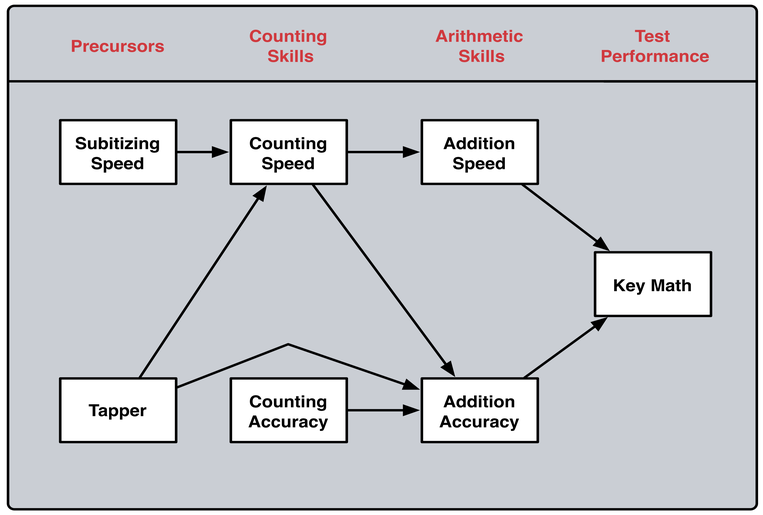
Young children use their fingers to represent quantities, count, and perform operations such as addition and subtraction. Thus, fine motor ability may predict children's early math skills (Barnes et al., 2005; Fayol & Seron, 2005).

Even young children demonstrate the ability to subitize (i.e., quickly enumerate small sets without evidence of counting). Subitizing is posited to be a core ability upon which formal skills such as counting and arithmetic are built (Butterworth, 2005; Dehaene et al., 2005).

We examined the relations among fine motor ability, subitizing speed, and early math skills including counting, addition, and performance on a standardized test of math achievement.

Children in grades 1 - 2 (n=123) participated as part of the Count Me In project. Children completed tasks of fine motor ability (finger **tapper**), **subitizing** (1-3 items), **counting** (4-6 items), **addition** (sums up to 10), and completed a standardized test of math achievement (**KeyMath**). Children also completed a test of processing speed and the Peabody Picture Vocabulary Test (PPVT).

Linear regressions were performed and paths with significant unique variance, after accounting for the effects of grade, processing speed, and receptive vocabulary (PPVT), are shown.



Counting speed mediates the relation between subitizing and arithmetic

Subitizing speed predicted counting speed, as hypothesized. This finding is consistent with the position that subitizing and counting are separate but overlapping processes and that counting builds on subitizing (Piazza et al., 2002). Counting speed predicted addition speed, as hypothesized given that primary children often use counting to solve arithmetic problems. Counting speed also predicted addition accuracy. This finding is consistent with the position that children who can solve a problem quickly (i.e., the fast counters) are better able to form an association between operands and an answer, as the operands are still activated in memory when the answer is calculated (Geary, 1993).

Fine motor ability predicts arithmetic accuracy

Tapping predicted counting speed, as hypothesized given that young children use their fingers to count. Tapping not only predicted addition accuracy indirectly, via counting speed, but directly predicted significant unique variance in addition accuracy.

Our findings are consistent with the notion that fine motor ability influences the development of early math skills in at least two ways: procedurally, affecting speed of executing finger-based strategies such as counting, and representationally, affecting ease in using fingers to represent numerical quantities. Thus, the link between fine motor ability and early math skills may reflect the use of fingers as portable manipulatives that provide a bridge from concrete to abstract representations of quantity and of operations.

Subitizing and fine motor ability both predict early math skills. Our research shows that fine motor ability predicts arithmetic performance both directly, and indirectly via counting speed.

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