"How Many are There?": Subitizing vs Counting Performance Across Primary Grades

Brenda L. Smith-Chant[1], Lisa Fast[2], Marcie Penner-Wilger[2], Sherri-Lynn Skwarchuck[3], Jo-Anne LeFevre[2], Jessie S. Arnup[2], Jeff Bisanz[4], & Deepthi Kamawar[2]

[1]Trent University, [1]Carleton University, [3]University of Winnipeg, [4]University of Alberta

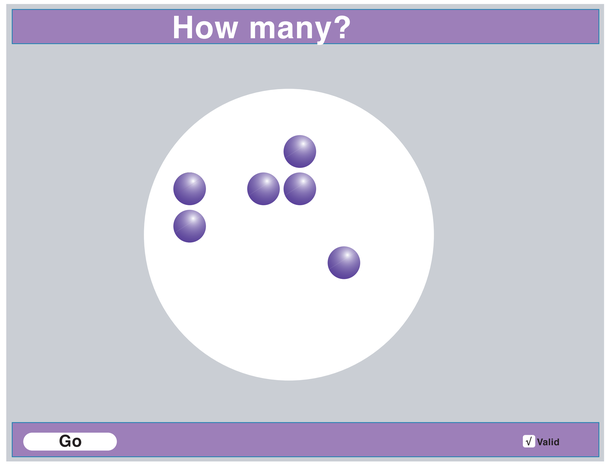
Subitizing is the observation that enumerating three or fewer items does not seem to involve overt counting. Evidence for subitizing is based on the observation that reaction times do not significantly increase across arrays of 1-3 items; however, there is a relatively constant increase in reaction times for each extra item with arrays of 4-9 objects.

Recently, Landerl et al. (2004) observed that individuals who are dyscalculic do not show evidence of subitizing and instead appear to be counting arrays of less than three. They propose that this atypical pattern in subitizing in early childhood may predict later problems with mathematics.

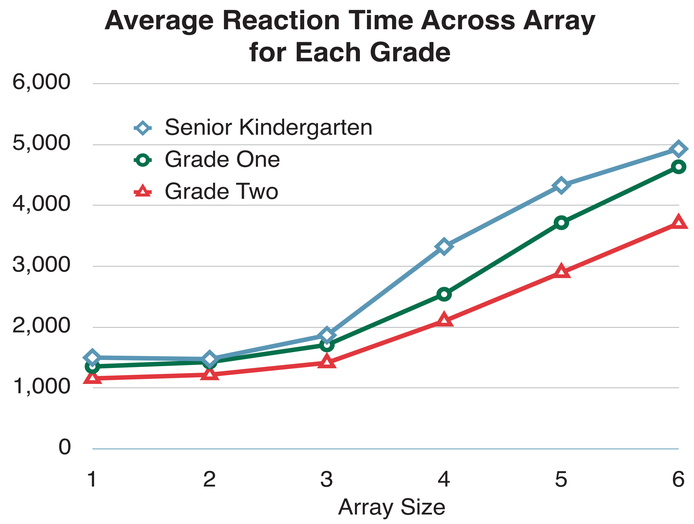
The current study is the first test point in a longitudinal study of the development of math skills among Canadian children.

255 children assessed	senior kindergarten	n = 82
	grade one	n = 90
	grade two	n = 83

A battery of tasks was used, including a computerized counting objects task ("How many are there?" for arrays of 1-9) and a subtest of a standardized test of mathematical achievement (KeyMath Numeration). Only data from arrays of 1 to 6 were available for analysis.



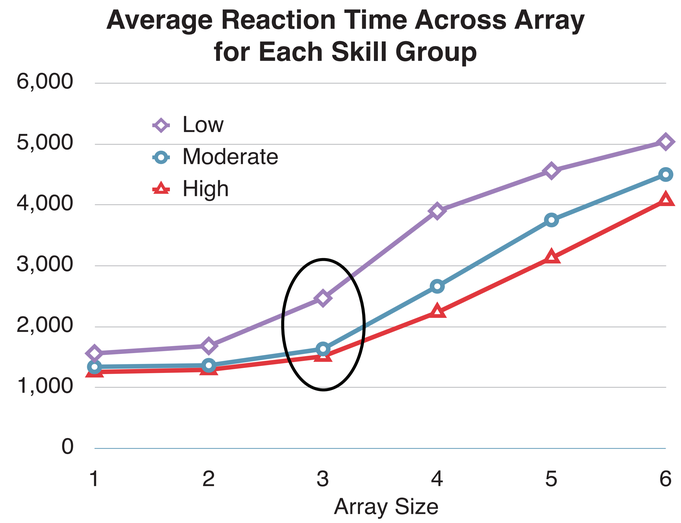
Children were accurate on the counting task (i.e., 98%), with no differences in errors across grades, skill level, or array size. In contrast, the reaction time pattern reveals different performance on this task across grades.



As seen in Figure 1, increases in reaction times across array size are very low from 1-3 items relative to 3-6 items. Generally, the change on the task across grade reflects a small decrease across grade in reaction times for subitizing and a more dramatic change for counting, reflected by a significant grade by array interaction. This pattern suggests that the two aspects of the counting task may follow different developmental trajectories.

Children were classified into skill groups based on their KeyMath scores, where low and high skilled children represented children scoring in the bottom top 16th percentile on the KeyMath Numeration Test (low n = 20, high n = 70, and remainder moderate-skill).

In Figure 2, the pattern across skill levels reflects that low skilled children showed evidence of a reduced subitizing range. Rather, they appear to be counting on arrays as few as three.



This is consistent with Landerl et al. (2004) and suggests that children with problems in math may qualitatively differ from children without math problems on basic numerical abilities such as subitizing. The interaction between skill and array was not modified by grade, suggesting that the lack of a typical subitizing pattern in low-skill children is stable.

As well, children who are low-skilled in general math knowledge seem to have a truncated subitizing range. These observations are consistent with Landerl et al.'s (2004) the notion that subitizing is a numeracy skill established prior to formal schooling and that problems with subitizing may be associated with difficulties in learning math during the early primary grades. As such, subitizing may be a core foundation skill for math.

SRCD, Atlanta, April 2005 www.carleton.ca/cmi/ bresmith@trentu.ca

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