

## Gesturing Helps Grade School Children Solve Math Problems

ScienceDaily (Nov. 5, 2007) — Are math problems bugging your kids? Tell them to talk back -- using their hands. Psychologists at the University of Chicago report that gesturing can help kids add new and correct problem-solving strategies to their mathematical repertoires. What's more, when given later instruction, kids who are told to gesture are more likely to succeed on math problems.

Researchers at the University of Chicago conducted two studies with a total of 176 children in late third and early fourth grade. Broaders and her colleagues randomly assigned the students to different manipulations -- told to gesture, told not to gesture, and not told anything either way (control). All participants had been found to make mistakes in solving math problems.

In the studies' baseline phase, students had to solve six math problems (such as  $6+3+7= \_ + 7$ ) on a chalkboard and explain to an experimenter how they solved each problem. The researchers coded the children's videotaped efforts, analyzing gestures and utterances that conveyed problem-solving strategies.

Children told to move their hands when explaining how they'd solve a problem were four times as likely (as kids given no instructions) to manually express correct new ways to solve problems. Even though they didn't, in the end, give the right answer, their gestures revealed an implicit knowledge of mathematical ideas. For example, to indicate the need for the sides to be equal, children might sweep the palm first under a problem's left side and then under its right side. Although those children weren't ready to turn that implicit knowledge into action (at that point they solved problems incorrectly), a second study showed that gesturing set them up to benefit from subsequent instruction.

In that study, the researchers assessed how gesture vs. no-gesture students performed after subsequent instruction in how to solve the math problems. At post-test, children who'd been told to gesture about math problems and then had a lesson solved 1.5 times more problems correctly as did the children who'd been told not to gesture -- a significant advantage.

The authors conclude, "Telling children to gesture encourages them to convey previously unexpressed, implicit ideas, which in turn makes them receptive to instruction that leads to learning." Gesturing appears to help children to produce new problem-solving strategies, which in turn gets them ready to learn. The authors speculate that gesturing may help kids notice aspects of the math problems that may be more easily grasped through gestural representation.

The findings extend previous research that body movement not only helps people to express things

they may not be able to verbally articulate, but actually to think better. At the same time, gesturing offers a potentially powerful new way to augment the teaching of math. Strategies for math problems have focused on externalizing working memory, such as writing things down in certain ways. However, children often find it hard to recall and use those strategies. Gesturing may be more accessible, and help break through the roadblock.

A report on these findings appears in the November issue of JEP: General, which is published by the American Psychological Association (APA).

Article: "Making Children Gesture Brings Out Implicit Knowledge and Leads to Learning," Sara C. Broaders, PhD, Susan Wagner Cook, PhD, Zachary Mitchell, BA, and Susan Goldin-Meadow, PhD; University of Chicago; Journal of Experimental Psychology: General, Vol. 136, No. 4.

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