

5. Do Manipulatives Help Children Understand Math?

In this thought-provoking *Theory Into Practice* article, Nicole McNeil and Linda Jarvin (professors at Notre Dame and Tufts, respectively) question the effectiveness of classroom math manipulatives. In theory, they say, manipulatives should enhance student learning because:

- They provide an additional hands-on resource for learning math concepts;
- They help children draw on their practical, real-world knowledge;
- They engage students in physical activity, which has been shown to enhance memory and understanding.

This sounds promising, say the authors, since “[b]ridging the gap between students’ intuitive, everyday understanding of mathematics and their understandings of the corresponding formal symbolic representations is one of the most significant challenges faced by math teachers today.” It’s not surprising that many teachers include manipulatives in math lessons.

But McNeil and Jarvin have bad news: “To date, there is no evidence that manipulatives help students make such connections.” The research is ambiguous and inconclusive, they report. Some studies show that hands-on math activities have no benefit, and others show that such activities may actually be detrimental to learning. And there are indications that manipulatives start to lose their effects after first grade.

How can this be? McNeil and Jarvin believe that there are two reasons for manipulatives’ very disappointing track record:

- *Teachers’ attitudes often undercut potential benefits.* A number of teachers use hands-on activities solely to pique students’ interest and add variety and fun to a lesson, failing to leverage manipulatives to enhance mathematical understanding. One teacher made this revealing comment: “Sometimes I think that they are just having fun, but I don’t mind because eventually we’ll get to the real math part.” Students pick up on this mind-set and come to regard hands-on learning activities as play time.

Most American teachers, say McNeil and Jarvin, “believe that mathematics is best taught by telling. That is, math is best taught by introducing the step-by-step procedures necessary for solving problems, repeating those procedures in clear language, providing students with an opportunity to practice those procedures, and providing feedback when necessary.” To get the most out of manipulatives, teachers need to embrace quite a different belief system – that students learn concepts more deeply when they construct their own understanding through well-orchestrated hands-on activities. Few teachers believe this.

- *Poorly chosen manipulatives can be the problem.* This happens most often when hands-on materials are everyday objects to children – toy cars, for example – and the teacher fails to explicitly make the link to their mathematical purpose in the activity. The

need for this “dual representation” is missed by many teachers, and as a result, their students, who tend to be caught up in their enjoyment of the objects per se, gain only a small fraction of the mathematical value of the activity.

The research evidence, say McNeil and Jarvin, suggests that “manipulatives are not a sure-fire strategy for helping children learn math.” So what are teachers to do? The authors have two recommendations:

- First, minimize the use of manipulatives that are “highly concrete and rich in perceptual detail” and familiar to children outside of school (e.g., toys). Manipulatives like these lead students to see the activity as mere play and make it more challenging for the teacher to make the link to math content.

- Second, take the time to “build explicit bridges between the informal understandings that children construct when they use manipulatives and the formal symbolic instantiations of the concepts.” This is not easy, the authors concede, but it’s essential to leveraging hands-on activities for true mathematical benefits.

“When Theories Don’t Add Up: Disentangling the Manipulatives Debate” by Nicole McNeil and Linda Jarvin in *Theory Into Practice*, Fall 2007 (Vol. 46, #4, p. 309-316), no e-link available; McNeil can be reached at nmcneil@nd.edu. (Marshall Memo 211, November 26, 2007)