Multidigit addition and subtraction methods invented in small groups and teacher support of problem solving and reflection.

In this chapter, we report on an investigation into the mathematical thinking of high-achieving second graders as they worked in groups, learning to add and subtract horizontal four-digit symbolic expressions using base-ten blocks and written marks. Our focus is on conceptual learning of multidigit concepts and methods and on how to support it. We begin the chapter by describing the study. Next, we discuss the educational implications of its results. The most important is that children can invent efficient written procedures, some of which are conceptually or procedurally superior to the standard school-taught algorithms. We end the chapter with some general conclusions about the teaching and learning of multidigit addition and subtraction. Our key conclusions are: (a) Teaching tools such as using cooperative learning groups and manipulatives (e.g., base-ten blocks) must be used carefully and thoughtfully to promote conceptual learning. In regard to the former, teachers must actively help children learn how to use small-group discussions as a problem-solving resource. In regard to using manipulatives, it is particularly important that children be encouraged to consider each step in their concrete block procedure when inventing (or attempting to understand a written procedure) and connect each concrete step with the corresponding step in the written procedure. (b) In contrast to the rigid use of algorithms learned by rote, conceptual learning promotes adaptive expertise and flexibility. (Orig.)

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