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# *Overview of Special Issue on Mathematics*

Reading has been the focus of much research and debate over the last 2 decades. This emphasis has been justified given the overwhelming number of individuals who struggle with reading in our schools across the grades (and into adulthood). We are familiar with the statistics that cite the importance of reading and what happens when individuals do not read at grade level in the early elementary years. The National Reading Panel has aptly addressed key areas of reading instruction including phonemic awareness, phonics, fluency, vocabulary, and text comprehension to help combat these difficulties and has provided recommendations and areas for future research.

Another area that must be examined just as closely as reading, given its importance in today's society, is mathematics. As Przychodzin, Marchand-Martella, Martella, and Azim state in this issue,

> In our rapidly changing and technologically dependent society, we are faced with the need for a solid understanding of mathematical skills and concepts. This need is no longer limited to scientific and technical fields. Virtually every type of employment requires a more sophisticated understanding of mathematics.… Given the emphasis of mathematical skills in our society, it seems critical that our students should demonstrate basic mathematical and higher order thinking skills to be successful in present and future environments. (pp. 53, 54)

This special issue of the *Journal of Direct Instruction* focuses on mathematics instruction and issues related to curriculum design. A focus on mathematics education is long overdue given what many students experience in terms of curriculum and content and how they actually perform on high stakes testing. Given recent efforts to incorporate research-validated programs and practices in our schools, schools and districts are now asking questions about how best to teach mathematics and what programs to use for maximum effects.

This issue includes seven articles ranging from an examination of education reform efforts in mathematics to how curriculum should be structured. Further, this issue provides information on Direct Instruction mathematics programs and their findings, including studies that examine *Connecting Math Concepts (Level K)* and *Corrective Mathematics*.

First, Hofmeister shares an intriguing look at the history of mathematics education reform. Hofmeister pinpoints a major faux pas that has occurred over the years—namely, that educators, curriculum designers, and others immersed in mathematics education efforts fail to apply sound research practices to decision making when developing and selecting mathematics curricula and when providing instruction. This lack of sound research application fails to lead us toward systematic and progressive improvements in mathematics education. Hence, we see large numbers of children performing poorly in math and math scores in this country lagging far behind other industrialized countries.

Second, a reprinted article from the 2002 *American Educator* by Schmidt, Houang, and Cogan describes the need for a coherent curriculum in mathematics. Schmidt et al. highlight an analysis of data from the Third International Math and Science Study (TIMSS) and cite the extreme disadvantage of American students and teachers because of our lack of a common, coherent curriculum and the materials and texts that go along with it. As Schmidt et al. find, curriculum does matter—what you teach is what you get!

Third, Snider examines the differences between mathematics programs organized in a spiral design and those organized in strands. Snider describes how many topics are covered in spiral or constructivist-oriented programs, but none are covered in depth. Conversely, the strand design is unique to Direct Instruction programs. In this approach a relatively small number of topics are covered over a long period of time. As topics are mastered, they are integrated into new strands that represent increasingly complex mathematical concepts.

Fourth, Stein, Kinder, and Milchick share a useful screening process and curriculum framework for evaluating commercially developed mathematics programs. This framework is aligned with the principles of Direct Instruction. A Mathematics Curriculum Evaluation Framework is outlined and is designed to help teachers evaluate mathematics programs to select new programs or to modify the mathematics programs available to them.

Fifth, Przychodzin et al. discuss how Direct Instruction mathematics programs meet the six principles for improving math instruction as provided by the National Council of Teachers of Mathematics (NCTM). Of particular interest is a research review and analysis of Direct Instruction mathematics programs that have been (i.e., *DISTAR Arithmetic I* and *II*, *Corrective Mathematics*, and *Connecting Math Concepts*) published since 1990 (yielding 12 studies). Seven of these studies compared Direct Instruction mathematics programs to other mathematics programs; 4 studies investigated the effects of Direct Instruction mathematics programs alone. Finally, a meta-analysis conducted by Adams and Engelmann (1996) is described. Characteristics for each of these studies were examined. These included reference, program or program comparison, participants, research design, dependent variable(s)/measures, and results. Eleven of the 12 studies (92%) showed positive results for Direct Instruction mathematics programs. Areas that should be targeted for future research are provided.

Sixth, McKenzie, Marchand-Martella, Moore, and Martella assessed the effects of teaching basic mathematics skills to 16 preschoolers (11 typically developing, 5 with developmental delays). The *Connecting Math Concepts Level K* (*CMC—K*) program was delivered by the classroom teacher to small groups of four to six children over 6.5 weeks. Children were assessed before and after the program using the Cognitive Domain of the Battelle Developmental Inventory (BDI) and the placement test for *Connecting Math Concepts Level A* (*CMC—A*). Results showed improvements across assessments with medium to large effect sizes noted.

Finally, Parsons, Marchand-Martella, Waldron-Soler, Martella, and Lignugaris/Kraft investigated the effects of a peer-delivered *Corrective Mathematics* (*CM*) program conducted in a secondary general education classroom. Ten learners who struggled in mathematics and nine peer tutors who excelled in this subject area participated. Peer tutors provided *CM* instruction for 10 weeks. Pre- and posttest data were collected on the learners and peer tutors using the Woodcock Johnson—Revised Tests of Achievement (WJ—R ACH) Calculation and Applied Problems subtests. Results showed that learners exhibited improved performance on the WJ—R ACH.

The performance of the peer tutors also improved as a result of serving as teachers.

In summary, this issue takes us from the historical perspective of mathematics education in this country to the need for a common and coherent mathematics curriculum. Particular emphasis is placed on a strand design. A screening process and mathematics curriculum evaluation framework is provided to help guide teachers and administrators in curriculum evaluation efforts. Further, given the emphasis on research-validated programs, an analysis of Direct Instruction mathematics programs published since 1990 is provided (yielding 12 studies). Two other studies targeting mathematics instruction for preschoolers and high school students, respectively, are shared adding to the powerful research base on Direct Instruction mathematics programs.