

Early Screening and Intervention in Mathematics Difficulties: The Need for Action

Introduction to the Special Series

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Virtually everyone in the field of learning disabilities (LD) is aware of current efforts in virtually every state and school district toward the use of measures to screen students with potential reading difficulties and to provide appropriate, intensive assistance to these students in the primary grades. Most are aware that the measures are not perfect—that many of them lead to false positives (i.e., they identify potential problem readers who would be unlikely to develop problems, even without interventions). Yet because interventions can be provided effectively in the child's general education classroom, often by the classroom teacher, and the child's progress monitored regularly, there is a sense that many of the disruptive effects attributed to "pullout" remedial programs will be avoided or, more realistically, minimized. We also are mindful that the current set of reading interventions provided is far from perfect, especially in the areas of vocabulary development and comprehension. Despite these caveats, however, most reading experts consider that both the screening measures used and the types of interventions provided target skills and knowledge that are critical to becoming a competent reader.

We are convinced that there is now adequate research to help guide the field in mathematics disabilities or difficulties. A major goal of this special issue is to begin to synthesize and com-

municate this knowledge, so that it can inform efforts currently being initiated in the schools. In the past year, articles in newspapers such as *The Washington Post* and *Boston Globe* have cited school districts' attempts to provide math intervention service; essentially, they reported a grassroots movement, with little reliance on research.

In this special issue, we attempt to communicate relevant findings and to find coherence in research that cuts across diverse traditions and diverse disciplines. In the lead article, with Jonathan Flojo, we synthesize the research base on the early identification and screening of mathematics difficulties. We also discuss promising theoretical foundations and approaches for early intervention for students likely to experience difficulty in learning elementary school mathematics. Our article is followed by a set of commentaries by leading researchers and scholars in the developmental and cognitive sciences and in special education. The commentators were challenged to expand on the themes or issues raised in the lead article, using their own research findings, their knowledge of other salient research, or their own reflections on the topic of early screening and identification of children with mathematics difficulties.

These are an extraordinary set of commentaries. Rather than provide a brief introduction to each, we merely introduce some of the major issues and themes that are discussed. The com-

mentaries help us recognize the limits of the current knowledge base. David Geary and Michèle Mazzocco, for example, both point out that the current knowledge base is limited to our knowledge of arithmetic disabilities, and that there may well be other, quite different indicators of potential difficulties on topics such as geometry or algebra. They also stress that mathematics difficulties are not stable for many students and, thus, any early screening battery may fail to locate the type of student who does fine with basic arithmetic in primary school but later will struggle with concepts involving fractions or algebra.

Daniel Berch, Ann Dowker, David Geary, and Michèle Mazzocco all highlight the importance of understanding the constructs that underlie the measures in a screening battery and stress how knowledge of effective intervention strategies should be guided by developmental and cognitive psychology. Jack Fletcher and Penny Chiappe both identify some specific ways in which the vibrant research on reading disabilities can inform current research in mathematics disabilities or difficulties. In particular, they note the importance of differentiating factors that are unique to mathematics disabilities (MD) from those that represent developmental lags.

Jack Fletcher shares some of his own data to demonstrate—as we point out in our article—that students with difficulties in both mathematics and

reading seem to be a unique group that does not overlap with students who have difficulties only in reading or only in math. His commentary implies the possible need for differential interventions for these groups of students.

A key issue, highlighted by Lynn Fuchs, Tom Hanley, and Diane Pedrotty Bryant, is the importance of using the response-to-intervention model as a means for classifying students as having MD rather than using older methods. Tom Hanley describes how the recently passed version of the Individuals with Disabilities Education Act (IDEA) allows for and actively encourages the use of such a model.

A number of the commentaries reflect on instruction and intervention for young children with or at risk for mathematics difficulties, with an eye toward prevention. Lynn Fuchs stresses the need for intervention studies in math that employ randomized controlled trials. She proposes important directions for this type of work, including studies that assess the effects of different instructional formats. Diane Pedrotty Bryant discusses how explicit instruction for children with mathematics difficulties can be integrated with inquiry-based instruction

and points out that these approaches do not need to be mutually exclusive.

Daniel Berch grapples with the concept of number sense and discusses its implications for instruction and intervention. He notes that although many agree that number sense is critical for the development of competence in mathematics, few agree on anything else about the concept. It is unclear how well number sense can be broken down into a set of discrete proficiencies, as many have done, for example, with phonological processing in the area of reading. Berch raises the issue whether number sense is best developed by systematic and explicit instruction or whether it is a byproduct of growth in arithmetic skills and concepts.

Ann Dowker describes ongoing, successful interventions in Europe and the United Kingdom that involve individualized assessments. The programs are based on componential, non-unitary theories of mathematical development and mathematics difficulties (i.e., a child may be proficient in one area of math but not in another) and are mindful of children's strengths and weaknesses in specific aspects of arithmetic.

In sum, we hope this special series will stimulate research and discussion on mathematics disabilities and difficulties. We also expect that it will lead to better screening methods and to the development of more evidence-based interventions for young children who struggle with numbers.

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