Responsiveness-To-Instruction to Strengthen the Academic Performance of Students with Reading and Math Disabilities

Final Report/Policy Brief to the Metro-Nashville Public Schools Assessment & Evaluation Department
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In this project, we addressed the following problem. Given the multiple academic needs associated with comorbid disorder, in combination with the demand for these students to participate in the general education curriculum, a major question is whether we can configure intervention efficiently to simultaneously address more than one academic need. Students with comorbid difficulty have more severe reading deficits compared to students with RD alone, and students with comorbid difficulty have more severe mathematics deficits compared to students with MD alone. At first grade, it is possible that two foundational component skills, word-level reading and number combinations, are linked via phonological processing as well as rapid naming. So it seems important to ask whether intervention may be efficiently designed to simultaneously address word-level skill and number combinations.

We randomly assigned first-grade students, who were at-risk for developing long-term reading difficulty, to three conditions: reading (decoding/fluency) intervention alone, reading intervention with math (number combinations) intervention, and control. In first two conditions, we provided students with one-to-one tutoring for 20 weeks, 3 times per week, for 45 minutes per session. We pre- and posttested students on a battery of reading and mathematics tests and collected pretest data on students’ attention and a battery of abilities associated with reading and mathematics learning.

Results indicate the answer that intervention may be efficiently designed to simultaneously address word-level skill and number combinations. Reading intervention combined with number combination intervention produced reliably stronger number combination outcomes compared to reading intervention alone and compared to the control group, and effect sizes (ESs) were large. This is not surprising. Only number combination intervention was designed to enhance number combination outcomes.

More interestingly, however, were effects on reading outcomes. Students who received combined intervention (reading intervention plus mathematics intervention) outperformed students in the control group, with moderate to large ESs on timed and untimed reading outcomes (across word and non-word measures). By contrast, children who received reading intervention alone did not reliably outperform students in the control group. Most interestingly, improvement on number combination fluency fully mediated group differences between the combined and reading-only interventions on both timed and untimed reading outcomes, and improvement in number combinations fluency partially mediated the difference between the combined intervention and control groups on the timed reading outcome. That number combinations intervention should improve reading performance and that improvement in number combination fluency should mediate reading outcomes create the basis for hypothesizing that these lower-order reading and mathematics skills overlap in some important ways; that some of the same cognitive abilities contribute to both forms of academic competence.
Another important finding from the just-completed grant is the role of teacher ratings of student attention. Such ratings significantly predicted students’ word reading growth in response to 4 months of intensive reading intervention combined with classroom reading instruction, even though other relevant predictors (phonological awareness, nonword reading, sight word efficiency, vocabulary, listening comprehension, hyperactivity, nonverbal reasoning, and short-term memory) were included in the model. Also, ratings of student attention demonstrated a significant indirect effect on third-grade reading comprehension via word reading, but not via listening comprehension. Together, these results suggest that student attention (indexed by teacher ratings) is a powerful predictor of at-risk readers’ responsiveness to reading instruction in first grade and that first-grade reading growth mediates the relation between students’ attention and their future level of reading comprehension. This indicates that managing and improving behavioral inattention during reading instruction may enhance future reading comprehension.

So major policy conclusions based on this project are that (a) intervention for first-grade students with risk for long-term reading difficulty should incorporate a number combination fluency intervention component and (b) teachers and tutors should strive to manage and improve behavioral inattention during classroom reading instruction and supplemental reading intervention at first grade.